chnol
y

MINING AND ENGINEERING WORLD

With which is Incorporated The Mining World Index of Current Literature

No. 25. Vol. 44. JUNE 17, 1916. 10 cts. a Copy; $3 a Year.

UNIVERSITY OF TORONTO
JUN 22 1916
MINING ENGINEERING

The Last Step in Pipe Evolution—

"NATIONAL"

"NATIONAL" Spellerized Pipe —The Last Word in the Art

¶ It took years of experiment, research and experience to develop the special grade of ductile material used in "NATIONAL" Pipe.

¶ It took further years to perfect the process of supervision and Spellerizing that insure the continuous ***uniformity*** of "NATIONAL" Pipe—that insure smaller scrap losses, better welding, better threading, increased resistance to corrosion.

¶ It took years to build up the great National Works, from a little 20x125-ft. shop to the complete plants covering hundreds of acres, making "NATIONAL" tubular and allied products that can fill promptly any "NATIONAL" Pipe order for any pipe service.

¶ Today "NATIONAL" Pipe is ***MEETING MODERN NEEDS.***

¶ "NATIONAL" ***Bulletin 11—a valuable publication that describes the evolution of Pipe—mailed you on request. Write!***

¶ To readily identify "NATIONAL" material and as protection to manufacturer and consumer alike, the practice of National Tube Company is to roll in raised letters of good size on each few feet of every length of welded pipe the name "NATIONAL" (except on the smaller butt-weld sizes, on which this is not mechanically feasible; on these smaller butt-weld sizes the name "NATIONAL" appears on the metal tag attached to each bundle of pipe).

LOOK FOR THE MARK

Name Rolled in Raised Letters on National Tube Company Pipe

¶ When writing specifications or ordering tubular goods, always specify "NATIONAL" pipe, and identify as indicated.

¶ In addition, all sizes of "NATIONAL" welded pipe four inches and under are subjected to a roll-knobbling process known as Spellerizing to lessen the tendency to corrosion, especially in the form of pitting. This Spellerizing process is peculiar to "NATIONAL" pipe, to which process National Tube Company has exclusive rights.

NATIONAL TUBE COMPANY, ***General Sales Offices,*** **Pittsburgh, Pa.**

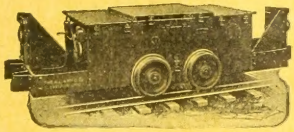
District Offices in the Larger Cities.

UNIVERSITY OF TORONTO
JUN 19 1916

Buyers' Index, 102-115. Index to Advertisers, 127-128. Professional Directory, 116-121. Contents, 1138.

STORAGE BATTERY LOCOMOTIVES

For Mine Haulage Have Proven Their Efficiency. They Require No Trolley or Third Rail.



No. 5750—Storage Battery Locomotive. End Operated. Two and 2½ Ton Type.

Send for Bulletin describing our full line.

Mine Cars, Smelter Cars,

Complete Industrial Railway Equipment

THE ATLAS CAR & MFG. CO.

Dept. B. 1275 Marquette Road CLEVELAND, OHIO

2

ALBANY GREASE

is very efficient on the bearings of a winding machine. It eliminates waste and increases the efficiency. A large mine conducted exhaustive tests and found that Albany Grease showed a saving of 82% over oil and ordinary grease. Why not conduct a test on your winding machine or any other machine in your mine. We'll send a quantity of Albany Grease and a Cup. No charge. Why not write—now.

ALBANY LUBRICATING CO.

708-10 WASHINGTON ST. NEW YORK

Write for Catalog M-4, prices and references.

CYANIDE PRECIPITATES, GOLD and SILVER

and for Melting Gold, Silver, Nickel, Cobalt, Brass, Copper, Aluminum, Etc.

We guarantee a saving of 60%, using oil and gas instead of coal or coke, in the

Steele-Harvey Crucible Tilting Melting Furnace

now in use in the largest wide-awake plants of the United States, Canada and Mexico. Various sizes.

We manufacture the Rockwell Double and Single Chamber Cyanide Bullion Melting Furnaces for oil or gas.

We also build Tilting "Coal and Coke" Crucible Furnaces.

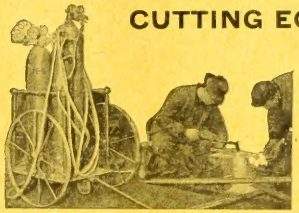
The Monarch Engineering & Manufacturing Co.

1200-6 American Bldg., Baltimore, Md., U. S. A.

K-G WELDING & CUTTING CO., Inc.

556 West 34th Street, New York City

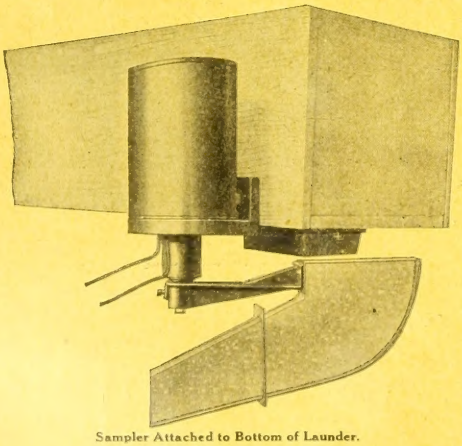
OXY-ACETYLENE WELDING and CUTTING EQUIPMENT



This apparatus is particularly adapted to the mining and engineering field and no mine should be without one.

Write for Booklet

Flood Automatic Sampler



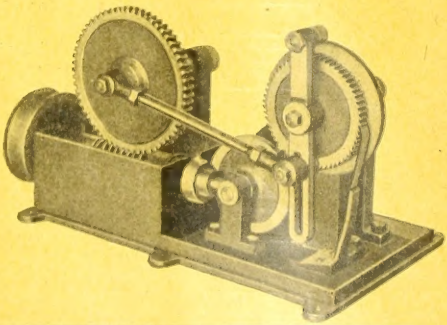
Sampler Attached to Bottom of Launder.

Will find where the losses are in your mill. You should take samples at regular intervals at various points.

By means of the Belt-Driven Timing Device shown below, the FLOOD SAMPLER automatically samples your ore or tailings at any predetermined intervals.

Electrically operated. Simple and accurate. No trouble to install. No attention required to operate.

Send for a copy of our "FLOOD" Catalog.



The Hendrie & Bolthoff Mfg. &. Supply Co.

DENVER

340,000 lbs. up a 6% Grade at 1000 ft. per minute on a 9000-ft Slope

is the daily duty easily performed by this

W. S. M. Electric Hoist

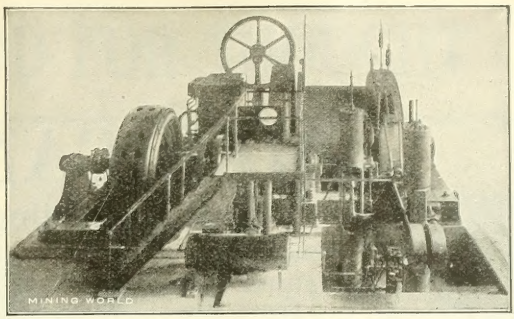
8′ x 60″ Drum, built of steel throughout, with Wuest single reduction herringbone gears, powerful friction clutch and weighted safety brake—air operated.

700 HP. MOTOR—22,000 VOLTS, (with latest type of liquid control) connected to hoist by flexible coupling.

Massive Construction, Simple Design.

Complete safety appliances.

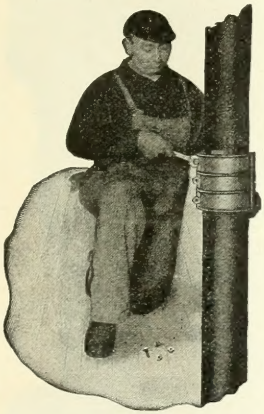
ENTIRE SATISFACTION IN OPERATION



Send us details of your requirements.

THE WELLMAN-SEAVER-MORGAN CO.
CLEVELAND, OHIO

NEW YORK: 50 Church St. DENVER: 612 Ideal Bldg. 19

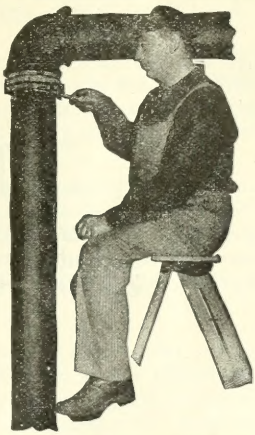


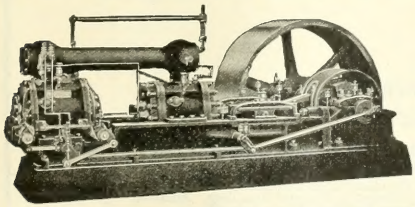
You Men in Charge of Isolated Plants—

who are trying to keep up with "forced draft" output! You can't afford to shut down one minute. You know the effect of a split pipe or leaky joint. Don't take the chance. Keep 8″, 10″ and 12″ Emergency Pipe Clamps on hand and when trouble starts slap the clamp on quick—without turning off your steam, water or air—the repair is positive and permanent. Saves tearing out of pipe and cost of new material.

Our little red "Pipe Repair Book"—tells how to meet every possible pipe, joint, or flange leak—read it, no obligation.

M.B.Skinner & Co.
558-562 Washington Blvd., Chicago





Modern Air Compressor

Variable Capacity
Constant Speed
Uniform Pressure

Starts with no load. Regulated by hand. Runs full load, part, or no load, according to the demand. Regulated automatically by air pressure. Unloads both stages of a compound compressor in same proportion, thus preserving at all degrees of load the proper division of work in the air cylinders. Not a superheating Squeeze-Off or By-Pass, but an entire dropping of load, running light, free and cool with no fuse-blowing or belt-breaking labor in resuming work. Picks up load progressively.

THE NORWALK IRON WORKS COMPANY SOUTH NORWALK CONNECTICUT

AMERICAN ZINC
Lead & Smelting Company

Executive Offices: 55 Congress St., Boston, Mass.

Operating Offices: 1012 Pierce Bldg., St. Louis, Mo.

Sales Offices:

2646 Equitable Bldg., 120 Broadway, New York, N. Y.

Producers of

"Mascot" Spelter

for cartridge and other high grade brass. Also all intermediate grades of Spelter and "Caney" Prime Western; Zinc Ores, Lead Ores and Sulphuric Acid.

Purchasers of

Zinc Ores

AMERICAN ZINC, LEAD & SMELTING COMPANY

Mines in Joplin District, Missouri, Carterville, Missouri.
Zinc Smelters at Caney and Dearing, Kansas. Address, 1012 Pierce Building, St. Louis, Missouri.

AMERICAN ZINC COMPANY OF TENNESSEE

Mines at Mascot, Tennessee.

AMERICAN ZINC COMPANY OF ILLINOIS

Zinc Smelter and Sulphuric Acid Plant at Hillsboro, Illinois. Address, 1012 Pierce Building, St. Louis, Missouri.

WISCONSIN ZINC COMPANY

Mines in the Wisconsin District, Platteville, Wisconsin.

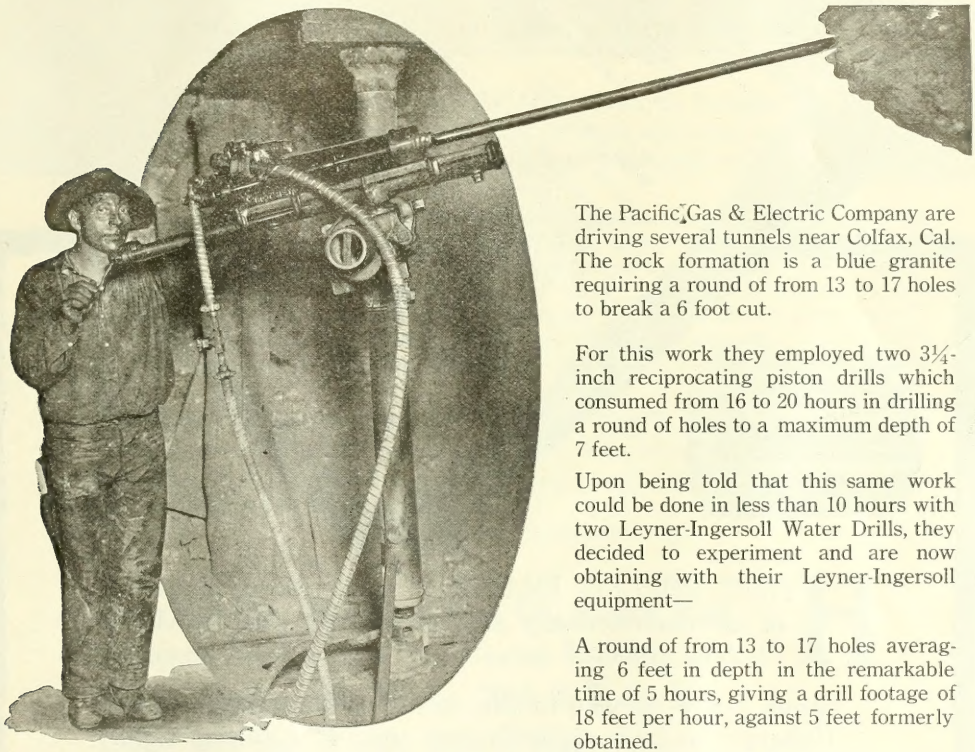
AMERICAN ZINC ORE SEPARATING COMPANY

Huff Electrostatic Separators and Plumb Jigs for the Treatment of Complex Zinc Ores. Address, 1218 Foster Building, Denver, Colorado.

AMERICAN BALLAST COMPANY

Producers of Crushed Rock for Road Making and Railroad Ballast. Producers of Powdered Lime Stone for Fertilizer Purposes. Address, Holston National Bank Building, Knoxville, Tennessee.

A LITTLE FOOD FOR THOUGHT



The Pacific Gas & Electric Company are driving several tunnels near Colfax, Cal. The rock formation is a blue granite requiring a round of from 13 to 17 holes to break a 6 foot cut.

For this work they employed two 3¼-inch reciprocating piston drills which consumed from 16 to 20 hours in drilling a round of holes to a maximum depth of 7 feet.

Upon being told that this same work could be done in less than 10 hours with two Leyner-Ingersoll Water Drills, they decided to experiment and are now obtaining with their Leyner-Ingersoll equipment—

A round of from 13 to 17 holes averaging 6 feet in depth in the remarkable time of 5 hours, giving a drill footage of 18 feet per hour, against 5 feet formerly obtained.

Carr Bits are employed, using four changes of steel, starting 2⅛-inch and bottoming 1¾-inch.

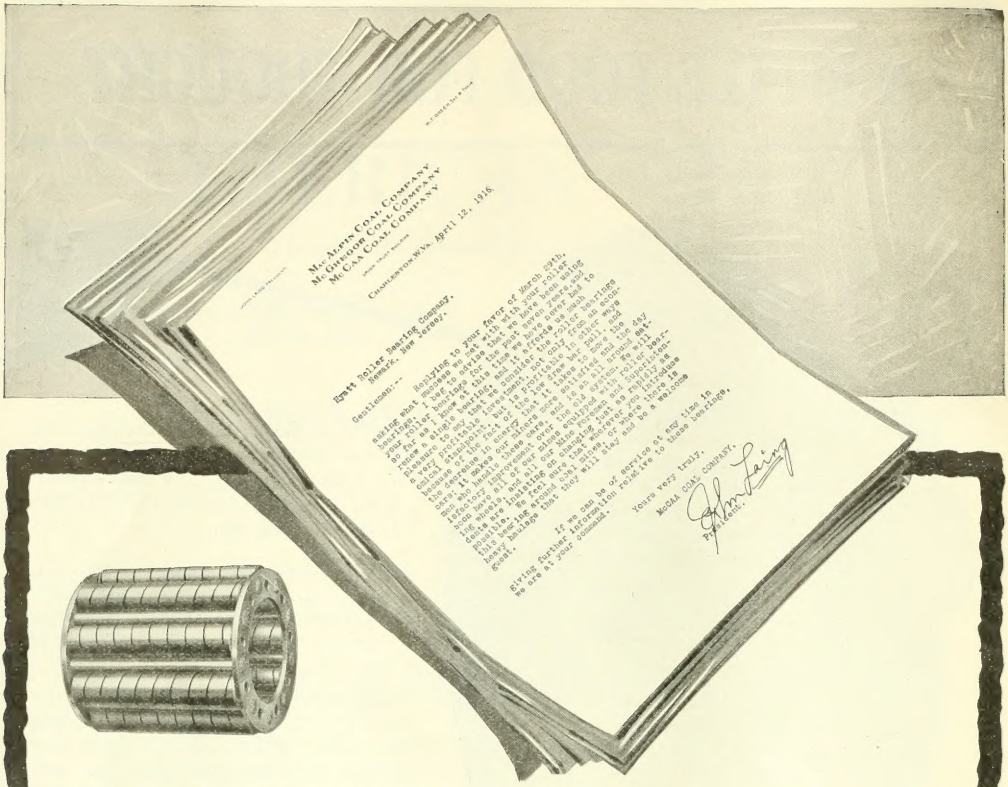
Perhaps Leyner-Ingersoll Drills Can Help You. Ask for Bulletin 4120.

INGERSOLL-RAND COMPANY

11 Broadway, NEW YORK **165 Q. Victoria St., LONDON**

For Canada, address Canadian Ingersoll-Rand Co., Montreal.

Air Compressors *Jackhamers* *Stopehamers* *Drill Sharpeners*



HYATT ROLLER BEARINGS make good, because of a fundamentally correct design—that of the Flexible Roller.

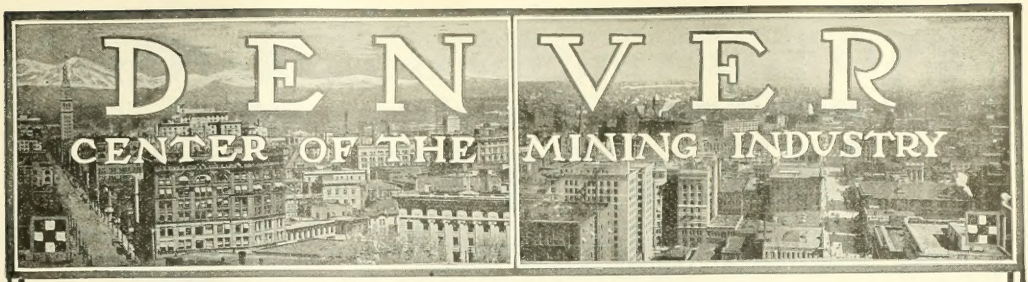
Seven years' service in the mines of the McCaa Coal Company and no replacements necessary during that time.

That is one of the many letters telling of the make-good ability of the Hyatt Flexible Roller Bearing—its ability to make good on saving power, on saving oil, on increasing production.

The many wheel designs in which the Hyatt Roller Bearing can be incorporated are illustrated in the Hyatt Why Book.

HYATT ROLLER BEARING CO.
NEWARK, NEW JERSEY

313



For more than half a century DENVER has been the Leading Mining Machinery Center; and a very large number of the most important mines, mills and smelters of the continent have been equipped with complete outfits coming from DENVER.

The companies named below can furnish everything needed for the modern mining and metallurgical plant; such as compressors, drills, cars, skips, hoists, crushers, screens, elevators, conveyors, rolls, stamps, tube mills, ball mills and other fine grinders, concentrating tables, pneumatic jigs, classifiers, dewaterers, thickeners, agitators, vanners, pumps, sampling and laboratory plants, mechanical roasters, electrostatic separators, assay and chemical supplies, smelting and bullion furnaces of all types, converters, ladles, slag pots and all accessory apparatus, including power machinery, pulleys, gears, shafting etc., rails, screen bars, riveted steel pipe, electrical apparatus and supplies.

The largest and only complete stocks in the West are carried in DENVER.

With railroads radiating in all directions, delivery on orders can be made promptly.

Save Money and Time, insure the efficiency of your plant and Secure Repair Parts immediately, when needed, by ordering from DENVER.

American Zinc Ore Separating Co., Foster Bldg.,
Colorado Fuel & Iron Co., Boston Building,
Denver Engineering Works, 30th & Blake Sts.,
Dillon Box Iron Works, 19th & Blake Sts.,
Hendrie & Bolthoff Mfg. & Supply Co., 1621-39 17th St.,
Mine & Smelter Supply Co., 17th & Blake Sts.,
Morse Bros. Machinery & Supply Co., 1721 Wazee St.,
Samson Crusher Mfg. Co., 33rd and Blake Sts.
The Dorr Company, 1009 17th St.
The C. H. Shaw Pneumatic Tool Co., 35th & Wazee Sts.,
The Stearns-Roger Mfg. Co., 1718-20 California St.,
Truax Manufacturing Co., 1117 Wazee St.,
Weigele Riveted Steel Pipe Works, 30th & Larimer Sts.

DO You Want the Benefit of Competition in Purchasing Supplies for Your Mine, Mill or Smelter?

If so, let us quote on your requirements. We buy from mill or factory on the best possible terms and can have direct shipments made to you, in large or small lots, at prices below what you are probably paying. Our sales include:

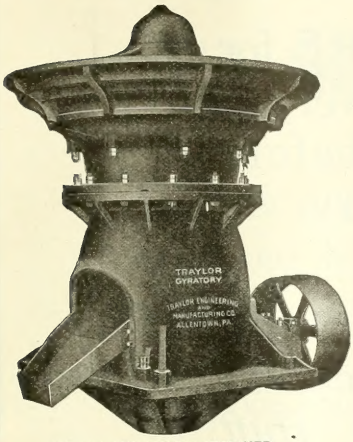
Air Tanks and Cylinders
Alloys
Anti-friction Metals
Anvils
Axles
Babbitt Metal
Balls—Steel, Brass and Bronze
Bars—Concrete
Bars—Iron and Steel
Beams—Channels and Angles
Bearings
Belt Dressing
Belt Fasteners
Belt Hooks
Belt Tighteners
Bending Machines
Boiler Compound
Boiler Plates
Boiler Shop Tools
Bolt and Rivet Clippers
Bolts and Nuts
Boring and Drilling Machines
Brick—Chrome, Heat Insulating, and Magnesia
Buckets—Grab
Bushings—Phosphor Bronze
Castings—Iron, Steel, Brass Bronze and Aluminum
Cement—Portland, Belt, Iron and Rubber
Chains
Chasers—Threading
Chemists' Supplies
Chucks for Machine Tools
Clamps
Clutches
Coils of Pipe, Iron, Copper and Brass
Concrete Machinery
Concrete Reinforcement
Condensers
Controllers—Electric
Corundum Wheels
Cotter Pins
Couplings—Flange and Pipe
Cranes—Hand Power, Locomotive and Portable
Crank Shafts
Creosoted Timbers
Cross Ties—Steel
Cutters—Gear Pipe and Wire
Dies—Drop Forge, Gripping and Heading, Pipe Threading and Screw and Thread Cutting
Drilling Machines
Dust Collecting Systems
Economizers—Fuel
Emery Wheels
Engines—High-Speed
Exhaust Fans
Exhaust Heads
Expansion Bolts
Eye Bolt Machinery
Eye Protection Glasses
Fans—Ceiling
Feed Water Heaters and Purifiers
Feed Water Regulators
Files and Rasps
Flanged and Dished Heads
Flanges
Flasks—Foundry
Flexible Shafting
Forges
Forgings
Foundry Equipment and Supplies
Frogs and Switches—Railway
Furnaces—Oil, Coal and Gas
Galvanized Material
Gas Producers
Gauges—Machinists, Pressure and Vacuum
Grate Bars
Greases
Grinding Machines and Wheels
Guards—Machinery
Hack Saw Machines and Blades
Hammers
Hangers
Hoists—Chain, Rope and Portable
Horse Shoes and Calks
Hose and Tubing, Rubber and Flexible Metallic
Hydrants
Indicators—Steam or Gas Engine
Instruments—Recording
Jacks
Ladles
Lathes
Lathe and Planer Tools
Lathing Metal
Leather—Cup, Hydraulic and Lace
Lockers
Lubricants
Mechanical Draft Apparatus
Metal Checks
Metals—Bearing, Brass and Bronze
Nails
Nuts
Oil Burners
Oil Filters
Oilstones
Oilers
Oxy-Acetylene Welding and Cutting Apparatus
Oxygen
Packing—Asbestos and Rubber, Iron and Wool Felt
Picks
Phosphor Bronze
Piling—Sheet Steel
Pipe
Pipe Covering, Asbestos and Magnesia
Pipe Cutting and Threading Machines
Pipe Fittings
Plates—Iron and Steel
Pneumatic Shop and Structural Tools
Powdered Coal Plants
Pulleys and Idlers
Punches and Dies
Punching and Shearing Machines
Pyrometers
Rail Bonds
Rails
Railway Equipment and Supplies
Ratchet Drills
Reamers
Rivet Sets and Stands
Riveting Machines
Rivets
Roofing and Siding
Rope and Cordage
Rope Dressing and Preservative
Rubber Goods
Saws
Scales
Screws
Separators—Steam and Oil
Shafting
Springs
Sprockets
Staples
Steam Traps
Stokers—Mechanical
Structural Iron and Steel
Superheaters—Steam
Taps and Dies
Thermometers—Recording
Tires—Truck
Tools—Blacksmith, Carpenters', Machinists' and Pipe Fitters'
Towers—Transmission
Track
Transmission Machinery
Tubing
Turnbuckles
Twist Drills
Unions
Vises
Washers
Water Softening and Purifying Apparatus
Water Towers
Wheels
Wrenches

We can furnish supplies for the company store or commissary and can undertake orders for the purchase of anything needed in a mining community. ***Get in Touch with Us.***

M. B. Skinner & Co., *Distributors,* **558-562 W. Washington St., Chicago, Ill.**

Do You Know the Remarkable Efficiency and Economy of

Traylor Products

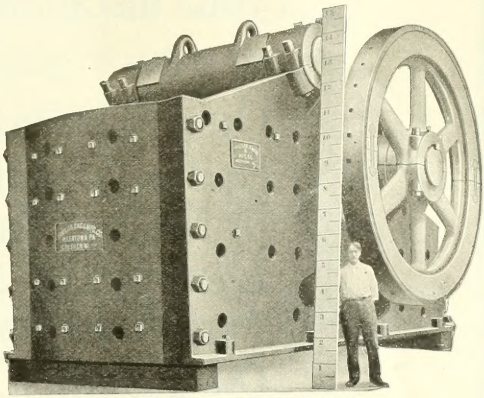


NO. 7½ GYRATORY CRUSHER.

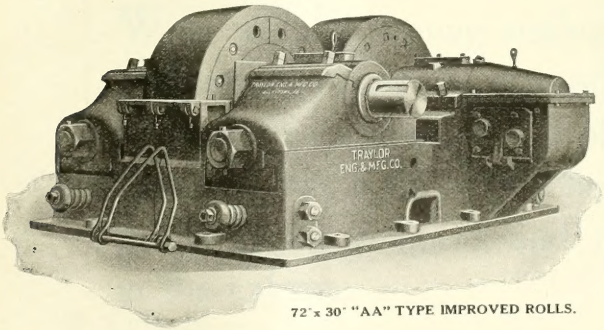
TRAYLOR JAW CRUSHERS have WATER COOLED MAIN and PITMAN BEARINGS of extra large diameter and babbitted with the BEST GRADE of BABBITT; PITMANS of CAST STEEL; MANGANESE STEEL WEARING PARTS, insuring long life of crushers; ADJUSTING MECHANISM, which regulates the stroke and size of discharge opening while crusher is in operation. Built in sizes from 7″x 10″ to 66″x 86″ with FRAMES of SEMI- or CAST STEEL.

TRAYLOR GYRATORY CRUSHERS have the BEST ECCENTRIC and OILING SYSTEM of all Gyratories; also CAST STEEL GEARING, MANGANESE STEEL WEARING PARTS, etc.

Built in sizes to meet your needs.



60″x 84″ LARGE JAW CRUSHER.



72″x 30″ "AA" TYPE IMPROVED ROLLS.

TRAYLOR CRUSHING ROLLS with LATERAL AUTOMATIC ADJUSTING or "FLEETING ROLL" DEVICE, eliminates CORRUGATING or FLANGING of SHELLS, increases CAPACITY, decreases COST of UPKEEP and allows you to WEAR YOUR SHELLS DOWN to a THINNESS never possible before or WITH ANY OTHER CRUSHING ROLL.

Built for any CAPACITY and size product.

"THE ULTIMATE CRUSHING EQUIPMENT"

Send for Catalog "G-3" and "A Successful Roll Operation".

Traylor Engineering & Manufacturing Company

Main Office and Works: Allentown, Pa., U. S. A.

New York Office: 34 Church Street. **Western Office: Newhouse Bldg., Salt Lake City, Utah**

TEST YOUR ORE for commercial recovery of your values before you install machinery.

Our laboratory is fully equipped with all modern processes, including *Huff Electrostatic Separator* and *Plumb Pneumatic Jig* and *Oil Flotation.*

Write—

American Zinc Ore Separating Co.

1218 Foster Building, Denver, Colo.

The Wedge Mechanical Furnace

PATENTED

Far-Sighted Economy

The best is the cheapest if you want tonnage and high efficiency roaster furnace operating days for the year.

It is poor economy to save on installation cost at the expense of operating cost if you desire to keep up production through high as well low metal markets.

Write us fully, stating analysis of ore, concentrates, mixtures or material you desire to roast, characteristics and physical condition of same, number of tons to be treated per twenty-four hours, and results desired in the calcine.

WEDGE MECHANICAL FURNACE COMPANY
Greenwich Point, Philadelphia

National Defense and International Peace

Preparedness and Peace and the Engineer

THE United States desires peace, based on justice and maintained with honor. But to insure this kind of peace Americans must know that nations are now defended not alone by fighting men, but by fighting industries.

The Engineers of this country, trained as only American Engineers are trained, hold that truth to be as fundamental as the law of gravity. With the authority of the United States Government more than 30,000 Engineers and Chemists, members of five eminent American scientific bodies, are making for the first time in the history of the Government a minute, sweeping survey of the industrial resources of America. They will go to the factories and mines of the land and with their sole method, efficiency, and their sole motive, patriotism, form a vast, flexible organization, such as the world has never known.

Their work will be the basis for creating in this country a true line of defense in time of war—the ability to produce swiftly, abundantly and with sustained power all the thousand and one elements of modern warfare. Without such production there can be no efficient army and navy.

Military Preparedness wins the battle. But *Industrial Preparedness* wins the WAR! Industrial Preparedness involves no huge expenses. Only the KNOWLEDGE of what American Industry can do. To KNOW the extent of each plant, the equipment of each shop, the capacity of each machine, the ability of each man. THAT is the essence of Industrial Preparedness. That is the task to which thirty thousand Engineers and Chemists are pledged.

The Engineers' and Chemists' work will lay for all time the ghost of the "munitions trust" by making it possible to have munitions made in thousands of plants.

This vital work of the Engineers and Chemists will supply the military authorities in Washington with information never before collected, and it is carried forward without a dollar's cost to the Government. And this advertisement is not paid for. The Associated Advertising Clubs of the World have prepared the copy and the publishers have patriotically responded and printed it without pay for the sake of National Defense and International Peace.

All Americans are asked to strike hands with the Engineers and Chemists so that America shall learn how to raise up an impregnable wall of defense against a day of trial.

COMMITTEE ON INDUSTRIAL PREPAREDNESS OF THE NAVAL CONSULTING BOARD OF THE UNITED STATES

IN CO-OPERATION WITH

THE AMERICAN SOCIETY OF CIVIL ENGINEERS — THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

THE AMERICAN INSTITUTE OF MINING ENGINEERS — THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

THE AMERICAN CHEMICAL SOCIETY

ENGINEERING SOCIETIES BUILDING — 29 WEST 39th STREET, NEW YORK

Jeffery Quad leaving mine at Plymouth, California, with two tons of sulphate.

How to Buy Haulage

EVERY mine operator must buy haulage. He must buy it as cheaply as he can if he wishes to decrease operating expenses. First he has to decide between horse and motor-truck haulage. That won't take long—if he investigates the real cost of using horses for hauling.

Then he must decide between various types of trucks. That too, is easy if he keeps in mind the one important thing—*when he buys a motor truck he is not merely buying a machine, he is buying haulage at so much a ton, or a mile.*

This means that he must consider not only the cost of the truck, but what it costs to operate the truck. He must consider not only how much the truck costs to get, but what it costs to keep year after year. He must consider not only what the the truck can do in good weather on good roads, but what it can do in any weather on any road.

If he starts out to investigate these things he will end by buying the Jeffery Quad—just as many other operators have done.

The Quad is the world-famous truck which drives, brakes and steers on all four wheels—built according to the specifications of army engineers to stand up consistently day after day, under the most exacting requirements ever demanded of road vehicles — the task of keeping up with an army under actual field service conditions.

The duplex governor — the "automatic chauffeur"—regulates the power to meet changing road resistance and so conserves the gasoline consumption. The M. & S. Locking Differentials give a *positive* drive to all four wheels and put the power of the motor into the wheel or wheels that can get traction when the others fail to obtain a grip on the road.

The power-on-all-four-wheels principle of the Quad makes it go through hub-deep mud, through sand and snow, over seemingly impassable grades and trails where no rear-drive truck could go.

Many engineers are decreasing their operating costs with the Jeffery Quad. Others are solving hitherto unsurmountable conditions with it because it enables them to go where no loaded rear-drive trucks can go. Still others are enthusiastic because they never have to suspend work on account of impassable roads when they use the Quad. All of them are enthusiastic because the Quad gives them more and better service at lower cost.

Everywhere the Quad is making an unequaled record—just as it established a new world's record for 2 ton trucks when 3500 Quads were sold in less than two years.

For further particulars about the Quad—or about the complete Jeffery line which includes light-duty rear-drive trucks—address The Thomas B. Jeffery Company, Dept. MW6, Kenosha, Wis.

Jeffery Quad

Power on All Four Wheels

Advertised machinery is the most dependable.

Interested in Flotation?

¶ Let Volume VIII of Mining World Index of Current Literature show you what has been published on this important present-day development during the last half of 1915 and where to find it and how.

VOLUME VIII

Mining World Index of Current Literature

Now Ready for Mailing

¶ There are thousands of articles on other just as important subjects listed in this volume, all carefully classified and indexed in a way that makes them easy to find.

Price to subscribers, $1.50 per volume.
Others, $2.00 per volume.

Address

Mining World Company

Monadnock Block, Chicago

STANDARD DESIGN LOCOMOTIVES

Our standard design locomotives are built for hard work and to earn the maximum money for the owner.

These locomotives are built to operate at a distance from shops and facilities for repairs. They are simple in construction, with every part specially adapted to the demands upon it. This applies not only to the strength, but to the wearing qualities and accessibility for inspection and renewal.

We can make immediate shipment of locomotives of various sizes.

Get in touch with us.

AMERICAN LOCOMOTIVE COMPANY

30 CHURCH STREET, NEW YORK

McCormick Building, Chicago, Illinois. A. Baldwin & Company, New Orleans, La.
Dominion Express Building, Montreal, Canada.
N. B. Livermore & Company, San Francisco and Los Angeles, California.
Northwestern Equipment Company, Seattle, Wash., and Portland, Oregon.

SUPERLA BRAND *Represents New Process Friction Reducing Oils*

Superla Brand affords the Highest Degree of Lubrication at Minimum Cost.

SUPERLA CYLINDER OIL
SUPERLA ENGINE OIL
SUPERLA DYNAMO OIL
SUPERLA TURBINE OIL
SUPERLA MACHINE OIL

Every Drop Counts

Their Adoption by Leading Industrial Works of the World is the Strongest Proof of Their Lubrication Value and Power Saving Properties

Also Polarine FRICTION REDUCING MOTOR OIL

The Standard Oil for Motors

Manufacturers of MINING AND DOMESTIC CANDLES and MINER'S SUNSHINE

STANDARD OIL COMPANY

(AN INDIANA CORPORATION)

CHICAGO, ILLINOIS

Announcement

The New Deister Simplex Rougher, The New Deister Simplex Finisher, The Deister Simplex Slimer and The Deister Cone Baffle Classifier

embody all the very latest Deister Inventions and Improvements in Concentrators and Classifiers. They are positively the best machines on the market today.

This was impressively demonstrated in a recent competitive test made at Juneau, Alaska. The Alaska Juneau Gold Mining Company tested our Simplex Rougher, Simplex Finisher, and Cone Baffle Classifier very thoroughly and gave us the entire order for their new mill, consisting of 48 Roughing Tables, 102 Finishing Tables, and 75 Classifiers. Our Simplex Rougher handled 225 to 250 tons and at the same time made a clean concentrate, our Simplex Finisher handled 75 to 100 tons, and our Cone Baffle Classifier handled 115 tons per day.

The Alaska Treadwell Gold Mining Co. tested our Double Deck Simplex Slimers and found that each machine could handle 50 tons successfully, this being equivalent to 4 Vanner loads in their mill.

NOTE: The reason for this large capacity and perfect control of the line of separation on our **Simplex Tables,** resides in our patented **Duplex Plateau** which consists of several steps or rises along a diagonal line intermediate the dressing zone and the main concentrating portion of the deck.

We wish to make it clear to all who are not intimately acquainted with the personnel of the Deister Machine Company, that Emil and W. F. Deister are exclusively and permanently engaged with this company.

Remember, the **Deister Simplex** Tables are the only ones that embody the **latest** Deister Inventions. Look for the words **DEISTER SIMPLEX** in all our advertisements from now on.

We ask you to give us a trial order.

DEISTER MACHINE COMPANY

INCORPORATED JULY, 1912

HOME OFFICE AND FACTORY: 1933-2003 East Wayne Street, FORT WAYNE, IND., U. S. A.

LONDON OFFICE: No. 1 London Wall Bldgs., LONDON WALL, E. C.

AGENTS: WILLIAM L. REEDER, 410 Consolidated Building, Johannesburg, So. Africa TAKATA & COMPANY, 2 Yeiraku-cho, Nichome, Kojimachi-ku, Tokyo, Japan

Our Business is to REDUCE YOUR HANDLING COSTS

Our Automatic Skip Hoists reduce the cost of handling materials to a minimum.

Our Conveying and Elevating Machinery has a minimum cost for upkeep.

We make the largest variety of Mechanical Dryers in the world.

We also make a large line of Crushers, Feeders and Pulverizers.

THE C. O. BARTLETT & SNOW CO.

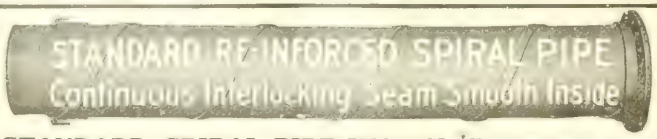
CLEVELAND, O. **50 Church St., N. Y.**

SPRINGS—Flat or Coiled

Any required shape or size. Made to sample or specification. Oil-tempered Crucible Cast Steel Springs for Machinery a Specialty

THE WM. D. GIBSON CO., Manufacturers

N. W. Corner Huron and Kingsbury Sts., CHICAGO



NO RIVETS—

Strong and Economical

Specially adapted for Water Supply and Ventilation Pipe in Mines—also for Dredging and Irrigation.

STANDARD SPIRAL PIPE WORKS, Rockwell and W. 48th Sts., CHICAGO

"It's a Waugh"

That's all you need to Know about a Stoper

THE first successful air feed stoper was a "Waugh"; and the "Waugh" drills have ever since been recognized as the standard type of stoping drill. With "Waugh" drills in your stopes you insure the greatest economy of repairs obtainable, rapid drilling, minimum of steel breakage, and contented drill runners—due to the ease with which these drills operate. They are designed in different sizes for all classes of rock, so you can be sure of getting one suited to your requirements.

THE Denver Rock Drill Manufacturing Co.

DENVER, COLO.

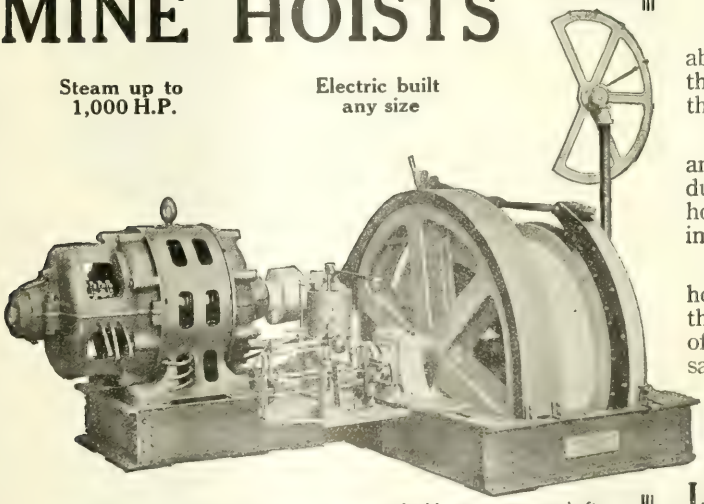
New York El Paso Salt Lake City Seattle San Francisco
Houghton, Mich. Joplin Butte Melbourne Johannesburg
Canadian Rock Drill Company, Ltd., Toronto, Ont., Selling Agents

L 14

LIDGERWOOD MINE HOISTS

Steam up to 1,000 H.P.

Electric built any size



Single keyed drum electric hoist for operating double compartment shaft. Weight of cage, car and load 14,500 lbs., speed 750 f. p. m. Complete safety device.

Safety, Capacity, Durability

Safety, Capacity, Durability, are the elements that govern the design of the Lidgerwood Hoist.

Every part is designed and built to perform its duty when the complete hoist is working at maximum capacity.

Our electric mine hoists are equipped with the most improved forms of automatic control and safety appliances.

Write for new Electric Mine Hoist Catalogue No. 15.

Lidgerwood Mfg. Co.

96 Liberty St., NEW YORK

Chicago Seattle Pittsburgh Philadelphia
London, England

The Minerals Separation Flotation Processes

Invented, Perfected and Owned by

MINERALS SEPARATION, Ltd.

of 62 London Wall, London, England,

and Its Affiliated Companies.

The Processes are protected in the United States of America by over forty patents and applications for patents, which include practically everything essential or of value in the use of the Process and Art of Air Froth Flotation of mineral values, *irrespective of whatever mechanical apparatus may be employed.*

The Processes are now in almost universal operation, yielding phenomenal recoveries and record breaking profits wherever properly installed as at Anaconda, Braden, Britannia, Inspiration, Timber Butte, and numbers of other important Copper, Zinc, Lead, Silver and Gold Mining Plants throughout the World.

The Plant is simple, inexpensive and "Fool Proof" and occupies very small space for its large tonnage capacity.

The Patent Rights for the United States of America, Canada, and Mexico are controlled by

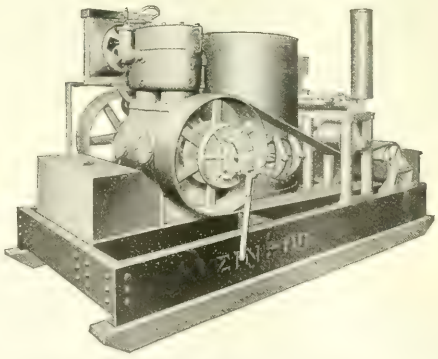
Minerals Separation American Syndicate (1913), Ltd

Sole Agents
BEER, SONDHEIMER & CO., Inc.,
61 Broadway
New York
Cable—"Beersond"

Chief Engineer
EDWARD H. NUTTER
Merchants Exchange Building
San Francisco
Cable—"Nomology"

Notice is hereby given that no one except our Chief Engineer and the Agents named above is authorized to act for or represent us, or to introduce Minerals Separation processes or apparatus into the United States, Canada, and Mexico. A testing laboratory is maintained in San Francisco for the purpose of testing ores by flotation, and samples sent to our Chief Engineer there will be tested at minimum expense to prospective licensees. **Infringers will be prosecuted.**

Continuous Service—



24 Hours Per Day—25% Overload

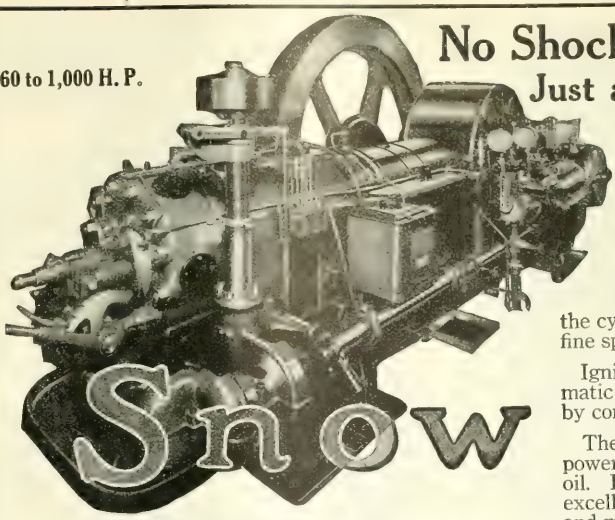
This is what some of the ZIN-HO Portable 4-cylinder, 4-cycle, gasoline-driven air compressor plants are doing.

May be you have exceptional requirements—if so write us for information.

We don't recommend overloading any machinery, but the rugged construction of these plants permits them to run continuously.

ZIN-HO Manufacturing Co.
1326 So. Michigan Blvd., Chicago, U. S. A.

60 to 1,000 H. P.



No Shock—No Vibration

Just a resistless thrust—

A steady, powerful, even stroke fits the Snow Oil Engine perfectly for driving compressors, generators, pumps, hoists, etc., where the even application of power is so essential.

The Snow Crude Oil Engine differs from the gasoline engine in that there is no explosion in the cylinder. The fuel oil is injected as a fine spray with the proper amount of air.

Ignition and combustion are automatic from the high temperature caused by compression.

The Snow Oil Engine develops great power on small quantities of cheap fuel oil. Its economical operation adds to its excellence as a prime mover for mines and mills—especially in isolated localities where coal is high.

Catalog S-130-33 sent on application.

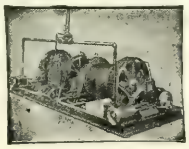
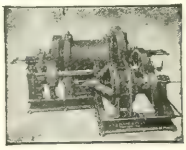
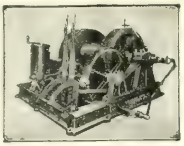
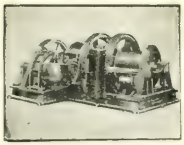
Oil Engine

WORTHINGTON PUMP AND MACHINERY CORPORATION

Successor to International Steam Pump Co., 115 BROADWAY, NEW YORK. **Snow Steam Pump Plant, Buffalo, N. Y.**

BRANCH OFFICES:

Atlanta Boston Buffalo Chicago Cincinnati Cleveland Denver Detroit El Paso Houston Kansas City
Los Angeles New Orleans Philadelphia Pittsburgh St. Paul St. Louis Salt Lake City San Francisco Seattle S198.4

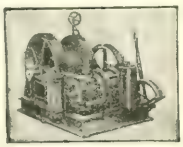
Every FLORY Hoist is Built to Meet the Requirements of the User

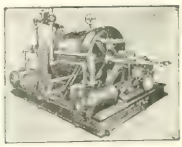
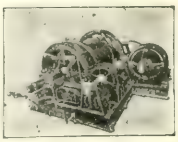
Views shown herewith represent a few of the more modern types of FLORY Mine Hoists. Others in great variety are in service throughout the country.

FLORY Hoists are the only ones on which the Werner Patent Band Friction can be used; and this is an exceedingly important advantage. A simple manipulation is all that is required to operate the friction—No complicated adjustments—No delay—Nothing to wear out. Safe—Sure—Reliable. Once the bands are thrown into friction they remain positively locked until released—Absolutely no chance for slipping.

TELL US YOUR CONDITIONS. LET US ACT AS YOUR HOIST COUNSELORS.

S. Flory Mfg. Co., Bangor, Penna. 95 Liberty St., NEW YORK



As the Crow Flies

Over Rivers, Mountains, Canyons and Valleys

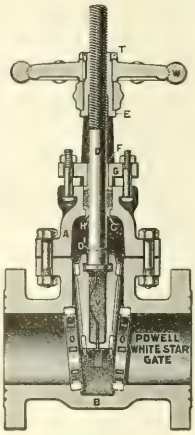
B&B AERIAL TRAMWAYS take the shortest route and reduce your haulage costs to a minimum. Every one designed especially to meet the particular requirements of each individual proposition. If you have a haulage problem, write us outlining your conditions, and our engineers will gladly furnish you with estimates and full information on the cost of an Aerial Tramway to meet your needs.

Send for Catalog No. 36

Broderick & Bascom Rope Co.
St. Louis, Mo.

POWELL VALVES

(Especially The "White Star" Valve)



We manufacture a complete line of

Gate Valves

Brass and Iron Body.
Rising and Non-Rising Stems.
Semi-steel and Monel Metal.
In sizes 2" to 16" Inclusive.
Screwed and Flanged Ends.

Ask your dealer for POWELL GATE VALVES or write us.

THE WM. POWELL CO.
DEPENDABLE ENGINEERING SPECIALTIES.
CINCINNATI, O.

GANDY

Try GANDY For That Hard Belt Service

WHERE everything is against the belt—where it is subjected to dampness, oils, greases, dust or dirt—try Gandy.

Because Gandy for 37 years has demonstrated that it can stand up against such conditions. Proof is all around you.

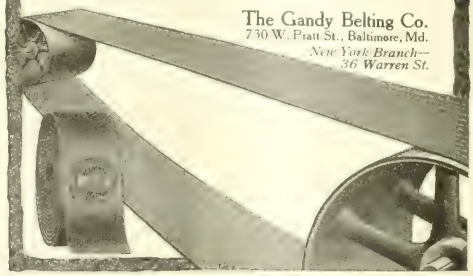
Gandy runs straight and true, and has a tenacious cling on the pulleys that reduces belt slippage and power waste.

Make the next belt a Gandy belt. Be sure you get The Gandy Belt with the Gandy trade mark stamped throughout the length of the roll.

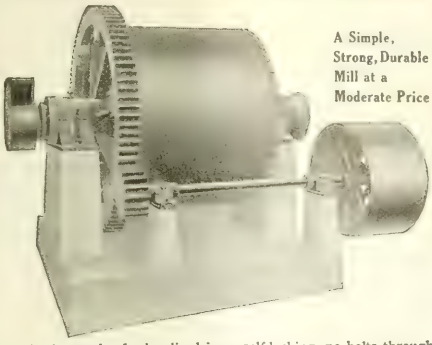
Our stock comprises all widths and all plies, from as narrow and as light as 1 in. 4-ply to as wide and as heavy as 30 in. 10-ply. This means your orders can be filled promptly with well seasoned stock.

Leading supply houses everywhere carry Gandy. Or, write direct to us for sample and prices. There is no obligation.

The Gandy Belting Co.
730 W. Pratt St., Baltimore, Md.
New York Branch—36 Warren St.



Standard Ball Mills



A Simple, Strong, Durable Mill at a Moderate Price

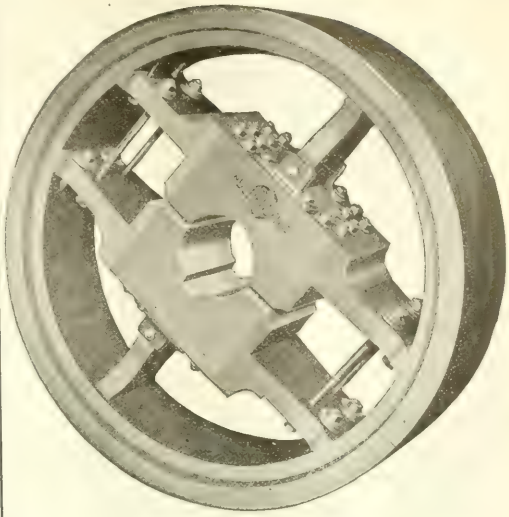
Lining made of spiegelized iron, self-locking, no bolts through shell. Scoop feed, trunnions, equipped with spiral feed and reverse spiral on discharge end.

The capacity and horsepower can be varied from above, depending on the steel ball charge, and is based on 1½ to 2-inch feed, and product 12-mesh and finer.

Capacity, Tons per Hour	Diameter Mill, Feet	Width Mill, Feet	Revolutions per Minute	Horsepower	Balls to Charge, Pounds
20.....	6	6	25	65	9,000
13.....	6	4	25	43	6,000
17.....	5	6	27	55	7,000
15.....	5	5	27	45	6,500
12.....	5	4	28	40	6,000
10.....	4	5	29	38	5,000
5.....	4	4	32	15	2,500
3.....	4	3	32	12	2,300

The Morse Bros. Machinery & Supply Company

1732 Wazee Street, Denver, Colorado



Dodge Wood Split Pulleys

Stamp Mill Type

Specially Adapted for Use on Crushing Rolls and Cam Shafts

Endorsed by the United States Reduction and Refining Co., Colorado Springs, Colo., where a number are meeting the requirements of extra heavy duty.

SHOCK ABSORBING
WEAR RESISTING

The Pulley with a Definite Guarantee.

Dodge Sales and Engineering Company

Distributor of the Products of Dodge Manufacturing Company

General Offices and Works: Mishawaka, Ind.

PORTLAND, ORE., and SEATTLE
Link-Belt and Dodge Products Company

DENVER
Hendrie & Bolthoff Mfg. & Sup. Co.

SALT LAKE and EL PASO
Mine and Smelter Supply Co.

SAN FRANCISCO and LOS ANGELES
Harron, Rickard & McCone, Inc.

Lindgren—Mineral Deposits

By WALDEMAR LINDGREN, Professor of Economic Geology, in charge of the Department of Geology, Massachusetts Institute of Technology; Geologist, United State Geological Survey.

839 pages, 6x9, 257 illustrations, $5.00 (21s) net, postpaid.

For many years Mr. Lindgren has been Geologist of the United States Geological Survey.

In this time he has come to be generally recognized as the leading authority on ore deposits.

The publication of this work on "Mineral Deposits" has been anticipated throughout the world.

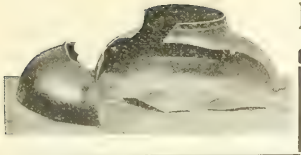
It is the first book to attempt to cover within reasonable space both metallic and non-metallic minerals, except coal and oil.

CONTENTS.

Deposition of Minerals. The Flow of Underground Waters. The Composition of Underground Waters. The Chemical Work of Underground Waters. The Origin of Underground Water and its Dissolved Substances. The Spring Deposits at the Surface. Relations of Mineral Deposits to Mineral Springs. Folding and Faulting. Openings in Rocks. Form Structure and Texture of Mineral Deposits. Oreshoots. Classification of Mineral Deposits. Deposits Formed by Mechanical Processes of Transportation and Concentration: Detrital Deposits. Deposits Formed by Chemical Processes of Concentration in Bodies of Surface Waters. Deposits Formed by Evaporation of Bodies of Surface Waters. Deposits Formed by Processes of Rock Decay and Weathering. Deposits Formed by Concentration of Substances Contained in the Surrounding Rocks by Means of Circulating Waters. Deposits Formed by Regional Metamorphism [illegible] Zeolitization. Deposits of Native Copper in Basic Lavas. Lead and Zinc Deposits in Sedimentary Rocks in their Genetic Connection with Igneous Rocks. Deposits Formed Near the Surface by Ascending Thermal Waters and in Genetic Connection with Igneous Rocks. Deposits Formed at Intermediate Depths by Ascending Thermal Waters and in Genetic Connection with Intrusive Rocks. Veins and Replacement Deposits Formed by Ascending Waters at High Temperature and Pressure and in Genetic Connection with Intrusive Rocks. Deposits Formed by Process of Igneous Metamorphism. Mineral Deposits of Pegmatite Dikes. Mineral Deposits Formed by Concentration in Molten Magmas. Metamorphosed Deposits. Oxidation of Metallic Ores. Calculation of Analysis and Representation by Diagrams.

MINING WORLD CO., Monadnock Block, Chicago

IT'S NOT READY TO JUNK



REPAIR IT

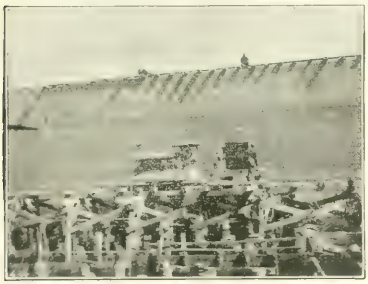
IMPERIAL WELDING EQUIPMENT belongs in every mine shop. An ordinary mechanic can take it and weld anything in metal—cut anything in wrought iron or steel. In a few minutes or a few hours he can make a broken part as good as new. Cost of part saved—days, perhaps weeks of delay avoided. In the case of an important part, one operation will save the entire cost of the equipment. Where is your next breakdown coming? You can't know but you **can** be prepared.

Follow your present impulse—write for Catalog and prices now.

IMPERIAL BRASS MFG. CO. 1208 W. Harrison St. CHICAGO

Plymouth Gasoline Locomotive Breaks World's Concreting Record On U. S. Dam Work

The Ohio River Contract Co., of Evansville, Ind., not only has broken all the contracting records on the longest movable dam in the world (No. 48 Ohio River), but it has cut them in half, by placing 9,810 cubic yards in 269 hours, including all delays, and at the same time saving $44 in cost every 8 hours.



From Photo

Here's What Secretary Eichel Says: "These two 'Plymouths' supplanted 12 mules on this work and each saved us $22 in cost every 8 hours," says Mr. Eichel. "On an 800-ft. haul the cost per ton mile was $0.07.61 which is a record in itself. They operated a maximum round trip of 1,600 feet, with stop for loading at mixer and dumping material. Average time for each 'Plymouth' was 4 minutes, day and night, for 22 days, including all delays."

Plymouth Locomotives Do Wonders in All Sorts of Duties

On construction work—in road building—in mines—in gravel pits—in brick-yards—and wherever haulage between two fixed points is a problem. Plymouth Locomotives are working low-cost miracles every day.

READ EICHEL'S FULL STORY—IT'S FREE TO YOU—We have a complete record of the contracting work done at Dam No. 48, which was supplied by the Chief Engineer and written by Mr. Eichel himself. It is full of interesting figures for contractors and will be mailed to anyone requesting it. A postcard will bring it.

THE J. D. FATE CO., 213 Riggs Ave, Plymouth, O.

In Reclaiming Your Mine Tailings—

You can cut the cost of handling to the minimum.

You can dig, convey, elevate and dump the material in one continuous operation by using the

Shearer & Mayer

Dragline Cableway Excavator

One machine, one operation, one man control. *Catalog on request.*

Sauerman Bros.

330 S. Dearborn St., Chicago, Ill.

DE LAVAL

Reg. U. S. Pat. Office.

Steam Turbines—
Single and multi-stage.

Double Helical Gears
for high-speed service.

Centrifugal Pumps—
Single and multi-stage.

Centrifugal Blowers
and Compressors.

Write for Catalogs.

DE LAVAL STEAM TURBINE CO., Trenton, N. J.

The Goodman Single-Motor Locomotive—

gives a positive maximum of haulage power per ton of weight. Because of the unit drive for the wheels, no wheel can slip until they all slip.

Flexible wheel base assures equality of wheel pressures, regardless of track irregularities.

The one armature has ample room for generous proportions.

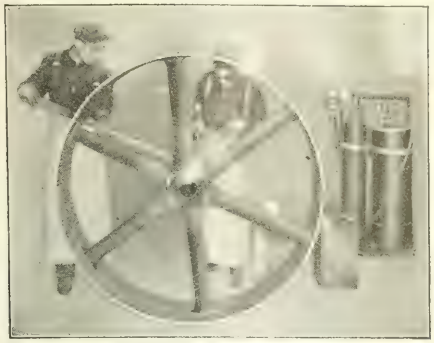
Unchanged for years in its fundamental design.

See our Bulletin No. 402-W.

Goodman Manufacturing Co.
Chicago, Ill.

Pittsburgh Cincinnati Charleston, W. Va. St. Louis
Nashville Birmingham Denver Seattle
(35)

Oxy-Acetylene Welding and Cutting



Welding repair on a pulley, 5 feet in diameter, using the Prest-O-Lite Process. Pulley was put back in operation. Just as good as new.

Makes Decided Savings In the Mining Field

There is no profit in your sending valuable material to the junk pile when a break occurs and renders it temporarily useless.

The value of material so "scrapped" in shops and mines even in one week amounts to an enormous sum.

You can avoid this loss by repairing breaks or defects in all kinds of machinery, making the repaired part as good as new, with oxy-acetylene welding. You can turn what would otherwise be junked and wasted into profitable, useful material. With oxy-acetylene welding equipment on hand, you can avoid costly delays and expensive replacements when important equipment breaks down, by welding the broken parts "right on the spot." One such repair oftentimes more than repays for the entire cost of the welding equipment.

It will pay you to investigate the

Prest-O-Lite PROCESS

Employs both gases (acetylene and oxygen), in portable cylinders. Prest-O-Lite Dissolved Acetylene (ready-made carbide gas) is backed by Prest-O-Lite Service, which provides dry, purified gas, insuring better welds, quicker work, and lower cost, and also avoids the large initial outlay and heavy depreciation incurred in making crude acetylene in a carbide generator.

Necessary equipment is not expensive. We furnish high-grade welding apparatus for $60 (Canada, $75); acetylene service at additional cost. Adaptable for oxy-acetylene cutting by the purchase of special cutting blow pipe. Thorough instructions are furnished free to every user of Prest-O-Lite Dissolved Acetylene—any average workman who understands metals can learn the process quickly and easily.

The usefulness of oxy-acetylene welding is practically unlimited in your shops and mines. New and profitable applications are being found daily. Write for valuable data on any phase of welding work—repairing, manufacturing or construction. Fully illustrated oxy-acetylene literature sent free.

The Prest-O-Lite Company, Inc.

The World's Largest Makers of Dissolved Acetylene

Main Offices and Factory
856 Speedway, Indianapolis, Ind.

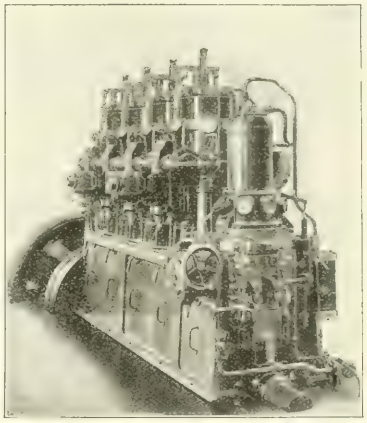
Canadian Office and Factory
Merritton, Ontario

53 Branches and Charging Plants

In the Power Plant, as the Wheels Begin to Turn

is where your Operating Costs begin—and continue as the every-hour item of your running expenses in Mine, Mill, Smelter or Refinery.

The economy that counts starts with the first turn of the engine shaft and works every hour of every day.



Southwark-Harris Valveless Engines

(Diesel Principle)

guarantee immediate and continuous economy—because they run on oil costing 3 to 4 cents per gallon, or 20 to 35 cents per 100 H.P. per hour, and have no delicate parts to get out of order.

They start with full load, like a steam engine, and can be brought **"From Stone Cold to Full Power in Ten Seconds."**

Southwark Foundry & Machine Company

400 Washington Avenue, PHILADELPHIA, PA.

Standard Gas Engine Company, San Francisco, Calif.
Exclusive West Coast Distributors.

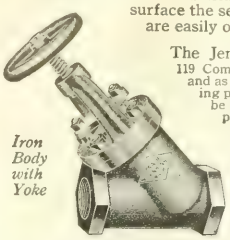
Jenkins Bros. "Y" Valves

Most Efficient for Blow-off Use.
Very Satisfactory When Handling Muddy or Gritty Water.

The straight, clear passage through the body offers practically no resistance to the flow of steam, or fluids of any kind.

Therefore, the valves are not only very desirable for blow-off use, where there is apt to be boiler scale, but are equally valuable for places where muddy, gritty or other impure water has to be handled.

On account of the small amount of bearing surface the seats never stick, and valves are easily opened and closed.



The Jenkins Disc—the new No. 119 Composition—assures a tight seat, and as the disc, seat ring, and all working parts are renewable, valves can be kept in good condition and repair at minimum expense.

Made in Brass and Iron Body, Standard and Extra Heavy Patterns.

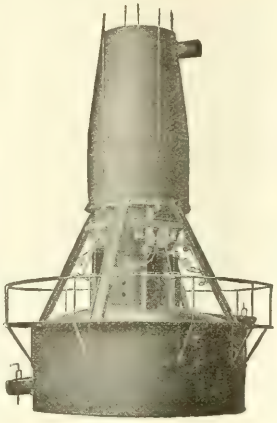
Write for Catalog No. 20 describing the full line of Jenkins Bros. Valves and Mechanical Rubber Goods.

Jenkins Bros. New York Philadelphia Boston Chicago

Jenkins Bros., Limited, Montreal, P. Q., and London, E. C.

12

How About Your Smelting?



Have you ever tried the modern way of smelting—the method that is today saving for its users thousands of dollars annually? Wile Electric Furnaces have demonstrated their ability to handle the most difficult ores, at a very low-power consumption, and have never failed to give entire satisfaction. The best proof we can offer is the repeat orders we are daily receiving from present users. You're interested, all mining men are. Why not write for our booklet "W"—it doesn't obligate—and it will be mighty interesting to you.

Write today—our supply is limited.

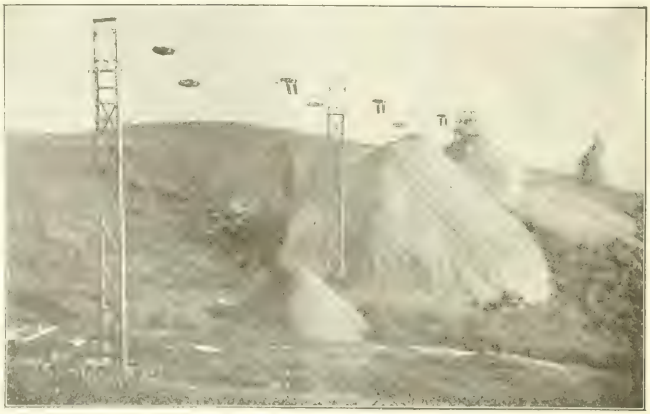
Wile Electric Furnace Company

8th Floor, Jenkins Arcade. Pittsburgh.

Distributing Material to Storage Pile or Spoil Bank

The Loop Line Tramway

with its continuous procession of barrows may be readily adapted to the distribution of material anywhere along the line by the simple expedient of equipping the barrows with drop bottoms, and the track with a movable tripping device which automatically unlatches the bottoms at any desired point.



This is but one of many services to which **Loop Line Tramways** are adapted.

Let Us Help You With Your Problems

Ambursen Company

61 Broadway, NEW YORK CITY

NEW YORK
35 Nassau St.
Phone Cortland 7331

SALT LAKE CITY
513 Felt Bldg.

MINING AND ENGINEERING WORLD

DENVER
1st Nat'l Bk Bldg.
MEXICO CITY, MEX.
SAN FRANCISCO
626 Market St.

No. 25. Vol. 44. CHICAGO June 17, 1916.

THE STANDARD'S MILLING PLANT.

STANDARD'S EXPERIMENTAL PLANT.

Flotation Process at the Standard Mill, Silverton, B. C.

By JAMES G. PARMALEE.

The mill of the Standard Silver-Lead Mining Co., of Silverton, B. C., is located on the shores of Slocan lake, 40 miles north of Nelson, and about 275 miles due north of Spokane, Wash. Milling has gone on in this district for the past 20 years or more, during which time the dividends of the various mining companies have passed the million mark many times, and the total production of this district will now reach $30,000,000. The total dividends of the Standard to date are $2,100,000. Water concentration has failed to recover the leaf-like zinc blende and ruby silver in the ore. Lately due to the demand for both these metals the flotation process has found much more general application, thus increasing mill extraction and decreasing tailings loss.

Two years ago, as a test there was installed a 6-compartment flotation machine to experiment on table and vanner tailings to recover zinc, galena and ruby silver. The experiment was unsuccessful, due largely to the high per cent of graphite schist in the gangue rock. This greasy schist responded all too readily to flotation, and therefore lowered the grade of concentrates made. The plant ran day and night, and but one man on a shift was required for one machine. The clogging of the pipes through which each succeeding agitator is fed choked frequently and caused all manner of trouble. The shaft bearings of the agitators caused much trouble due to heating. These with other difficulties led to the abandonment of the experiments on flotation at the Standard mill.

A year later George H. Wyman, Jr., of the Wyman Metals Flotation Co., of Spokane, installed a new flotation machine of his own invention. This article is in part a report on the operation of this machine in flotation work.

Geology.

The ores of the Standard, and in general of the other mines of the Slocan district, consist mainly of silver-bearing galena and zinc blende in a gangue of pyrite and quartz. The country rock is slate, and graphitic schist, which is freely intermingled with the ore. Silver exists not only in combination in the galena and blende, but also in the form of ruby silver, and with gray copper—less frequently native. The ruby silver usually occurs in cleavages, and is most frequently found in an association of the minerals, galena and blende. Native silver usually occurs in or on the galena. As a general rule the rich silver minerals exist in immediate proximity to galena or blende, and do not occur isolated in the quartz or schist.

The ores may be divided into two classes: Those amenable to water concentration, and those not amen-

able to it, mainly by reason of the large amount of blende occurring in streaks and coatings over the gangue. Similarly in certain cases the galena also appears to form in a very finely divided state with the graphitic schist and slate. It is to these last mentioned mineral occurrences that flotation has been employed and is now in operation at the Standard mill.

The Plant In Operation.

The graphite material of the schist at first caused considerable trouble owing to its accumulation in the concentrates. However, after various modifications of arrangements and trials of oils, the flow sheet herewith has been made final, and an installment and enlargement of the present flotation annex is a project for the immediate future. The feed to the flotation plant consists of the pulp from two Dorr thickeners, the pulp of which passes to a classifier making slime and sand.

The sand goes directly to a mechanically agitated flotation machine No. 1, the feed and products of which assay as follows:

	Silver.	Lead.	Zinc.
Feed	1.8	[illegible]	8.3
Tailings	0.7	0.1	1.3
Concentrates	23.2	11.0	47.0

The concentrates go to a temporary filtering plant, and thence to bins ready for shipment. The tailings are allowed to go into Slocan lake. To the first compartment of the machine is added a mixture of pine and fuel oils. This mixture in ratio of 3 of pine to 1 of fuel oil has been found best. A small amount of dilute commercial sulphuric acid is added. The product made here is satisfactory and the tailings assay shows 85 to 90% recovery.

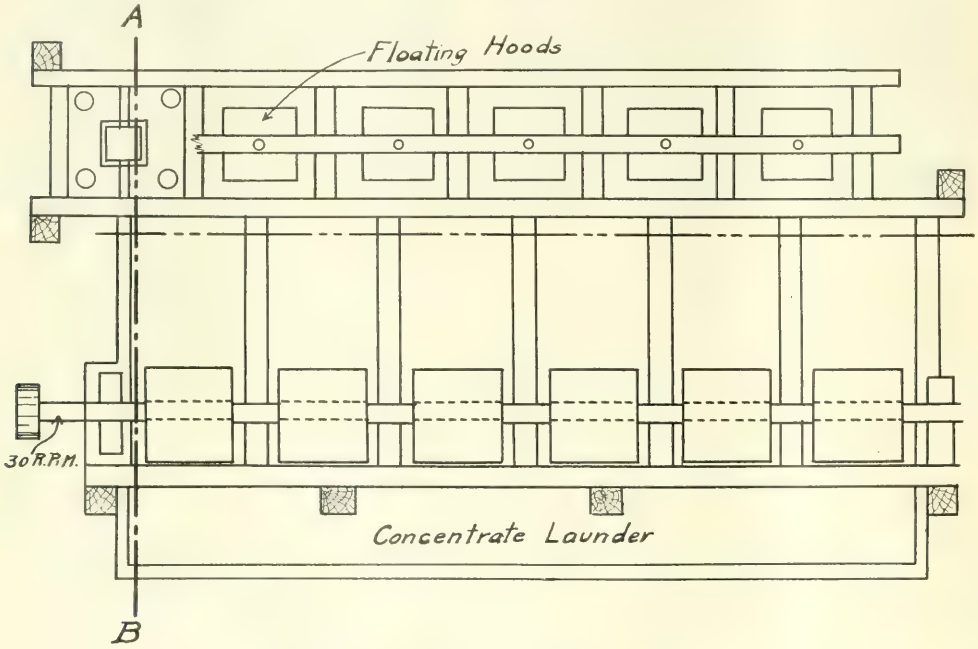
The slimes from the classifier come first to a Pachuca mixer, where oil (pine and fuel) are added, and a little acid. By virtue of the acid a concentrate high in lead and silver is obtained, while the zinc is low enough to avoid penalties in smelting. The tailings running high in zinc are caught on the following machine, thus giving a good separation. By air pressure the pulp is carried to the feed box of the Wyman pneumatic type, the products of which assay as follows:

	Silver.	Lead.	Zinc.
Concentrates	60	25	16
Middlings	3.3	2.6	10.7

No. 2 machine makes concentrates and middlings, the latter led to a flotation machine No. 3 of the mechanically agitated type. The No. 3 machine again makes concentrates and tailings, thus completing the process. The concentrates go to a filter and then on to storage bins. Oil is the only outside agent used in this machine. The product of No. 3 assays as follows:

	Silver.	Lead.	Zinc.
Feed	3.3	2.6	10.7
Concentrates	0.8	0.7	1.3
Tailings	12.5	6.2	50.1

The mill feed, or ore feed from mine, on the average assays, silver, 35 ozs.; lead, 24%, and zinc 14. These last figures, with the tailings of No. 1 and 3

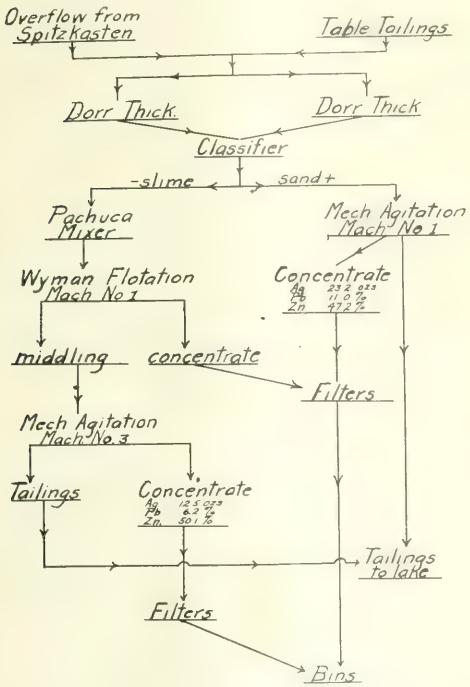


WYMAN PNEUMATIC FLOTATION MACHINE.

machines, show a 93 to 95% recovery as a whole.

Wyman Pneumatic Flotation Machine.

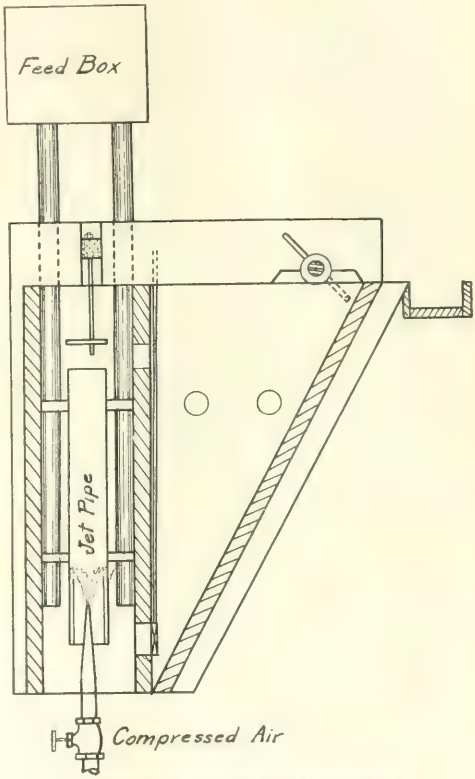
This machine is in the form of a V-shaped wooden box, the bottom of which is cut off parallel to a horizontal plane through the machine. The box is composed of six compartments, each of the latter being divided into a frothing and agitating space. In the bottom of each agitating column is an air jet supplied with suitable valves to control the air pressure. Up through the middle of the same is a square wooden frame, above which hangs a wooden baffle board and against which the pulp is forced by the air below. As the pulp splashes against the baffle, it tends to pass



STANDARD'S MILL FLOW SHEET.

out at a square opening even with the baffle, into the frothing compartment. Two holes, the size of which is regulated by sliding valves, are in lower front side of each agitator, and in and out of which the pulp passes in its cycle through the machine; being due to the suction into agitator, and then later an expulsion into the frothing compartment, etc. Two circular holes as shown in illustration, somewhat below the level of frothing compartment, serve to maintain the solution level through and out of the machine. A tap hole at bottom of far end serves to remove the tailings.

The most interesting feature of this machine is its simplicity. First, it has no pipes to clog; second, it has no mechanical power and thus no bearings to burn out or look after; thirdly, it has no valves and thus the labor required is small. The only attention necessary being the addition of oil and acid. The low cost of construction of this machine is also a point in its favor. One machine can easily handle



SHOWING METHOD OF INJECTING AIR.

30 to 40 tons of feed (pulp) with a ratio of water to solids of 4:1.

My thanks are due to George H. Wyman Jr., for many of the detailed points of information given, and to him should be given much credit for the solution of the flotation problem at the Standard Silver-Lead Mining Co.'s mill, and also in the Slocan mining district.

Surveys of the available water power throughout British Columbia show that 3,000,000 hp. may be readily developed from the streams of that province. Of this amount only about 8% is utilized up to the present time.

March imports of precious stones totaled $5,302,-296, against $1,234,935 in March, 1915, an increase of 330%. Imports for 9 months were $30,374,566 in 1916, $10,362,020 in 1915, and $27,092,818 in 1914.

Coal-Land Leases in Territory of Alaska

The Department of the Interior May 18 put into effect the general leasing bill enacted by Congress. The Department has issued a bulletin covering the provisions of the law, from which the following comments and explanations relating to operation and development are taken:

An explanation of those articles and provisions of the lease form whose purposes may not be self-evident follows. It should be understood that this explanation is not in any sense either a part of the lease or agreement or a construction of its terms.

It will be observed that the Alaskan coal-leasing act (38 Stat., 741) specifically states that—

> The unreserved coal lands and coal deposits shall be divided by the Secretary of the Interior into leasing blocks or tracts of 40 acres each, or multiples thereof, and in such form as, in the opinion of the Secretary, will permit the most economical mining of the coal in such blocks, but in no case exceeding 2560 acres in any one leasing block or tract.

In laying out the leasing blocks, or units, it has been the endeavor to arrange each block so that the coal may be reached by drifts, tunnels, slopes and shafts from adjacent valleys, or benches, and may be mined to the boundary of the lease by workings of reasonable length for underground haulage. In some cases, where the coal measures within a unit lie under high mountain ridges, it may be necessary to develop blocks by means of tunnels through adjacent leasing blocks.

Article 1, Section 1.

RIGHTS RESERVED BY LESSOR.

The lease plainly states that the lessor (represented by the Secretary of the Interior)—

> Reserves unto itself the right to grant or use such easements in, over, through or upon the land leased, entered, located, occupied or used as may be necessary or appropriate to the working of the same or other coal lands by or under the authority of the government and for other purposes. * * *.

The purpose of this provision is to permit railroads, tramways, water lines or other necessary means of transport and communication to be constructed and operated through blocks of land not reached by these means of transportation at the time these blocks were leased, and to enable leasing blocks or units not readily accessible on the surface to be reached by tunnels, slopes or other openings driven through the blocks already leased. Whenever it is necessary to grant or use an easement under this provision, the easement will be so arranged and located as to interfere in a minimum degree with mining operations on the blocks subject thereto. Wherever it seems advisable, jointly operated tunnels, slopes or shafts for transportation and ventilation may be permitted, provided the conditions, limitations, penalties and provisions contained in the act are observed. Whenever joint openings do not seem advisable, the openings for the operation of the subsequent leases will be required to be so driven as to interfere as little as may be with the operations of the prior lease or leases. Should there be material interference, the amount of damages to be paid to the prior lessee will be determined by a board of arbitrators elsewhere referred to.

Article 3, Section 1.

MINING RIGHTS LIMITED TO COAL AND ASSOCIATED MINERALS.

Article 3 provides that—

> The mining rights and privileges leased as aforesaid shall extend to and include only coal and associated minerals.

Article 8 (e) defines associated minerals as—

> Fire clay, shale, sandstone and the bedded materials of the coal measures, exclusive of gold-bearing or other metalliferous deposits.

Article 6, section 7, provides that the lessee—

> Shall promptly notify the authorized representative of the lessor of the discovery of any valuable mineral or mineral substance other than coal * * * and shall not mine or remove same unless the same is an associated mineral.

The same section provides that—

> Such quantities of fire clay, shale or gas from the coal measures as may be required by the lessor in the conduct of operations hereunder may be removed and used without such written permission and without payment of royalty therefor.

Thus, if the lessee discovers any mineral other than the associated minerals named above he should promptly notify the authorized representative of the Secretary of the Interior; but he may take such fire clay, shale or gas from the coal measures as he needs in his operations without paying royalty thereon. For example, fire clay may be taken out for use at boiler plants or shale for the making of brick used on the lease, or inflammable gas (methane) liberated by mining operations may be trapped underground and piped to the surface for use in providing heat or light on the premises.

Article 4, Section 1.

INVESTMENT.

The underlying purpose of this section is to prevent the tying up of a valuable block for speculative purposes. The requirement should not be an obstacle to an operating company that intends to proceed vigorously and systematically in the development of a lease, for all the expenditures made in actual mining developments on the property that do not represent promotion expenses or interest charges will be considered as investments. The expenditures for actual mining developments include all legitimate charges for prospecting, the driving of tunnels, drifts, entries or slopes, or the sinking of shafts, and also the construction of tipples, houses for the use of employes, trestles, tramways, storehouses, barns, stables, reservoirs, railroad tracks and all other work which may actually be essential in the opening and operation of a mine. Under these requirements it is expected, if the coal deposits prove to be workable, that at the end of the 5-year period the mine or mines on the lease will, or should be, developed to a tonnage capacity permitting commercial operation. In brief, the requirement is intended to insure the proper development of the lease should the coal be of such thickness and quality and under such conditions as would justify continued operations on a commercial scale.

Article 4, Section 2.

ANNUAL REN

The rental of 25 cts. per acre the first year and 50 cts. per acre for each of the remaining 5 years,

and $1 per acre per year thereafter, is an almost nominal charge if coal is produced in any considerable amount. For example: Suppose that the leasing block consisted of 1000 acres. The charge for rental or advance royalty at the end of the first year would be $250, and on the basis of 2 cts. per ton royalty on the coal this would call for a production of only 12,500 tons for the whole year, and from the second to the fifth year, to wipe out the fixed rental charge, it would require a production of only 25,000 tons annually. Even though no coal be mined, the total rental for the 5 years on 1000 acres would be only $2250, and it is likely that the lease would have been surrendered long before the end of the 5-year period if coal in commercial quantities was not being produced. On a lease of 1000 acres of coal land an output of 400 tons per day would be a moderate output. If the mine worked 250 days in the year, it would produce 100,000 tons. If development showed that part of the land under lease did not contain workable coal, then that part of the lease in 40-acre tracts could be surrendered by the lessee and the gross annual rental, equivalent to the advance royalty, could be lessened.

Article 4, Section 3.

ROYALTY.

The lease provides for—

* * * a royalty of 2 cts. on every ton of 2000 lbs. of coal shipped or removed from the leased lands or manufactured into coke, briquettes or other products of coal, or consumed on the premises, during the first 5 years succeeding the execution of this lease. * * *

The royalty for the opening period is made low in order to encourage the development of coal mines. A royalty of 5 cts. per ton after the mine or mines on the lease have been opened up is also low in comparison with the size of royalty required in many coal fields of the United States. Except for some extremely low royalties in the middle west, the range is from 10 to 25 cts. per ton. In Washington, which is more directly competitive with Alaska, the royalties range from 15 to 25 cts. per ton.

In some mines it may be necessary in determining the amount of coal extracted to measure the volume of the excavation rather than the weight of the coal, and the lease provides for such measurement. Special allowances may have to be made when the coal beds are very irregular and carry much impurity.

Article 4, Section 5.

CHARACTER OF REPORTS TO BE FURNISHED MONTHLY BY LESSEE.

The purpose of certain reports to be furnished by the lessee, in addition to those of coal shipped or moved from the premises, that is—

the number of cars of mine-run coal hoisted or trammed from each coal bed of each separate mine

is to enable the checking of the amount of coal excavated or extracted from each bed, which may be in turn checked by underground measurements, and in general to permit the obtaining of a check of the weighed quantities of coal.

The provision requiring the lessee to make—

* * * a report showing the quantity of coal [illegible] coal shipped, used for power purposes [illegible] tion; donated to employes, manufactured [illegible] or other products or by-products of coal; in storage on the premises, with the quantity of coal of various sizes added thereto and taken therefrom during the month

is almost self-explanatory. Although it may seem to be a burden on the operator, it is, on the other hand, only such information as a well-administered company would obtain for its own purposes.

Article 5.

PERIODS FOR READJUSTMENT OF ROYALTY.

As the rate of royalty during the first 25 years is low it is deemed advisable that there should be an opportunity for readjustment at the end of that period. It is expected that if bonds were issued, say at the end of the first 5 years of the development period, these bonds might run for 20 years, a customary period for mine bonds, and would be retired by the time the readjustment became effective. It will be observed, however, that the lease provides that in such readjustment the maximum limit of the royalty—

* * * shall not exceed 5% of the average selling price of coal of like character at the mine, per ton in the coal field embracing the tracts covered by this lease, as shown by the books of the lessees operating in said field, during a period of 5 years next preceding such readjustment.

By this provision, if the coal sold at $2 per ton according to the books, the royalty would not exceed 10 cts.; or if it sold for an average of $5 at the mine, the royalty would not exceed 25 cts. Such royalties under the conditions would be considered very moderate even at present. Undoubtedly when readjustments are made all conditions, including the market for coal and the competition from neighboring lessees, will be taken into consideration by the Secretary of the Interior.

Article 6, Section 1.

WORKINGS NOT TO BE ABANDONED UNTIL EXAMINATION MADE.

* * * No mine, entry, level or group of rooms or workings shall be permanently abandoned and rendered inaccessible, save with the approval of the authorized representative of the lessor.

It is the expectation that in or near each important coal-mining district of Alaska there will reside a local representative of the Secretary, who on due notice will make a prompt inspection and determine whether the operator shall be permitted to abandon certain workings. Any dispute arising may be submitted to a board of arbitration.

Article 6, Section 2.

PRELIMINARY PLAN OF MINING TO BE SUBMITTED IN ADVANCE OF OPERATIONS ON A COMMERCIAL SCALE.

This section provides that the lessee—

* * * shall develop and mine the coal in the leased lands in accordance with a system to be shown by a preliminary plan on a scale of not more than 200 ft. to the inch and a written description thereof, which plan and description shall be submitted for approval by the authorized representative of the lessor.

The provision may seem difficult where the structure of the coal measures is complicated, but on the other hand no thoughtful operator will consider it wise to start a mine without having some definite aim. Submission of this preliminary plan to the representative of the Secretary might in some cases lead to the obtaining of constructive advice which would be of value to the operator. The preparation of the pre-

liminary plan would necessarily be preceded by some prospecting.

Article 6, Section 3.

MINING OF TWO OR MORE BEDS.

Provision is made for systematically mining several beds at the same time, as follows:

Where mining operations are being carried on in a bed that lies either below or above another bed in which mining has been or is being carried on and in which the pillars have not been pulled, and where the vertical distance between the two beds is less than 15 times the thickness of the lower of the two beds, the lessee shall, as far as practicable, so arrange the pillars that those in the lower bed shall be vertically beneath those in the upper bed. Where practicable by reason of either commercial or mining conditions, the available coal in the upper beds shall be exhausted before the coal in the lower beds is mined.

The purpose of the first provision is to prevent pillars from resting on spans and the breaking of spans under the weight. Such conditions have led to collapse of mine workings and serious subsidence of the surface in the anthracite district of Pennsylvania. The last sentence of the paragraph lays down the general proposition that wherever such action is practicable the upper beds should be exhausted first. This is generally considered the best practice and should be followed wherever possible.

Article 6, Section 4.

FIFTY-FOOT BARRIER PILLARS AT THE BOUNDARY LINES.

The safety of the miners, as well as the property, demands that large barrier pillars be left between adjacent leases until the removal of the pillars by one or the other of the lessees becomes safe and expedient. The provision that the barrier pillar shall not be extracted until water that may have accumulated in adjoining abandoned workings has been lowered can in most cases be complied with, after permission has been obtained, by drilling holes through the pillar and drawing off the water in accordance with the methods followed in safe mining practice.

Article 6, Section 5.

LIMITATIONS OF COAL TO BE EXCAVATED IN ADVANCE WORKINGS UNDER THE ROOM-AND-PILLAR SYSTEM.

Under the "room and pillar," or any other method of mining that requires pillars of solid coal for the support of the overlying strata, the pillars must be large enough to furnish adequate support. In some parts of the United States it has been the practice to take so much coal in the advance workings as to bring undue strain on the pillars, roof of floor, with resulting fracture of the roof, crushing of pillars or squeezing up of the floor, endangering life and causing serious losses of coal. A "squeeze" in any mine is a grave reflection on the method of operation followed, yet "squeezes" are found in many coal-mining districts.

The percentages of extraction permitted for advance workings apply to different depths below the surface; they represent the maximum amount of extraction that should be permitted, and by no means represent the best practice, except the 20% specified for more than 1750 ft. of depth. Many mines in the Connellsville, Pa., district having less than 600 ft. of vertical depth of cover extract only 20% of the coal by advance workings. The very best practice is to mine out all the coal by the long-wall method and use waste rock to stow or pack the excavations behind the face.

The provision that—

The said coal areas shall mean an area parallel with the dip or raise of the coal bed. The percentages of coal to be mined in the areas comprised in the advance workings as compared with the percentages of coal to be left standing in such workings * * *

means that the area of the pillars is not to be calculated on the basis of a horizontal plane, but in the plane of the coal bed itself. The further provision that the percentage of coal to be left standing—

* * * shall not be construed to mean the percentage of the total amount of the coal in any such area of any such bed where such bed in such area is thicker than the height of any such workings * * *

means that the percentages of the areas must be considered and not the percentages of total coal. Obviously there is no difference between the two when the coal bed is not thicker than the height of the excavated drifts, levels, gangways, rooms of chambers, but if a room should be excavated to a height, say, of 8 ft. when the coal bed is 10 or 20 ft. thick, the thickness of the coal left up as a roof should be disregarded in figuring the strength of the pillars to resist crushing. The section also provides—

* * * nor shall such percentages of areas be held to include the coal extracted from the pillars in any such area, panel or district of the mine, as it is the intent of the parties hereto that, save as otherwise provided in this lease, and except where the retention of pillars shall be necessary for the maintenance of main roads or passageways or for the protection of the property, all such pillars shall be mined and removed as rapidly as proper mining will permit.

It is not the intent to prevent the withdrawal of the pillars when the rooms or chambers are driven to their proper distances, if no pillars in overlying beds would be affected by such withdrawal.

Article 6, Section 6.

FIRES IN MINE PROHIBITED.

To reduce the danger to life and the possible loss of coal by fires, it is provided that the lessee—

shall not, save as hereinafter authorized, light, keep or maintain any fire in any mine or stripping, except as approved by the authorized representative of the lessor, or underground in any mine, or in contact with the coal in place or in or along the outcrop of any coal bed.

This provision is to prevent the starting of fires for heating purposes where they might cause a serious fire in the mine or coal bed. Fires of this origin were formerly frequent in certain coal districts of the United States. An exception that is permitted, subject to the approval of the authorized representative, is the use of a ventilating furnace as a temporary ventilating expedient. Such furnaces, however, are to be constructed or arranged in accordance with the specifications of article 13.

Article 6, Section 9.

SECOND EXIT TO SURFACE TO BE PROVIDED WHERE MORE THAN TEN MEN ARE EMPLOYED ON A SHIFT.

To provide for the escape of men in the event of an explosion or fire, the lessee must—

* * * where more than 10 men are employed underground on any one shift in any separate mine, provide an escape way or second exit to the surface, which shall be separated at the surface from the first exit by not less than 50 ft. of strata in case of drift, slope or tunnel workings, or in case of vertical

shafts, or of inclined shafts [illegible] 45°, by not less than 200 ft. of strata.

The specified distances between the openings are not recommended, but must be regarded as the minimum distances permissible. The less the pillar between the manway or escapeway and the haulage way is broken by crosscuts the better the protection afforded in case of fire or explosion. All such crosscuts, if not in active use, should have strong fireproof stoppings; if in active use, they should have emergency doors of fireproof material which may be closed in time of accident. This section permits an alternative arrangement for an escapeway, as follows:

* * * An escape way or outlet through an adjoining mine shall be regarded as a sufficient compliance with this requirement if kept at all times in proper condition for use.

It is not considered the best practice to provide an escapeway through an adjoining mine that is active and employs 10 or more men, as an explosion or fire in one mine endangers the safety of the lives of the men in the other. A far better plan is to have separate exits for separate mines. However, where coal measures are so complicated as in some of the Alaskan coal fields, conditions may arise under which a second exit through an adjoining active mine is the best arrangement that can be provided promptly; but such an escapeway should have emergency doors and "explosion barriers" so that a fire or explosion in either mine may not endanger the lives of men in the other.

Article 6, Section 11.

NO BUILDING OF INFLAMMABLE MATERIAL TO BE CONSTRUCTED WITHIN 75 FT. OF ANY MINE.

This section provides that the lessee—

shall not construct or maintain any structure of inflammable material within 75 ft. of any mine opening; nor within said distance permit any structure of non-inflammable material to be connected to any other structure by means of any structure or erection of inflammable material, or to be connected to any structure beyond said distance which shall be constructed of inflammable material, except as follows, that is to say:

(a) An open-timber framework, or head frame of timber, may be constructed over a shaft, slope or incline,

(b) The posts, studs and rafters of any such structure may be of wood if the covering or lining is made of non-inflammable material, but under no circumstances shall wood flooring be used, except in tipple and trestle structures.

Under these terms surface buildings that by burning may carry fire into the mine with disastrous results are not permitted. The engine house and other buildings should have a floor of concrete, cement, or packed dirt. Under the stated provisions the main timbers of a headframe, or the posts, studs, and rafters of a covered passage may be of wood, but either the framework must be left open or the cover or lining must be of noninflammable material, such as galvanized or painted corrugated iron or steel, or cement or plaster based on wire mesh. It is much better practice to fireproof even the frames, if of wood, with a coating of cement or plaster on a reinforcement of wire mesh, or, better still, to make these members of steel.

Article 6, Section 12.

MAIN INTAKE AND RETURN [illegible] BY NOT LESS THAN 50 FT. OF NATURAL STRATA.

This section provides that the lessee—

except in a prospect opening, shall separate the main intake and return stairways and all workings parallel to such airways by not less than 50 ft. of strata.

Pillars of such size between the main intake and return airways are provided in ordinary mine layouts, and in many parts of the United States the main pillars are made thicker or wider than 50 ft. The provision insures an adequate separating pillar between the adjacent parallel entries and thus lessens the hazard from falls of roof and increases the protection in case of explosion or fire.

Article 6, Section 13.

FAN NOT TO BE PLACED IN DIRECT LINE WITH ANY MINE ENTRANCE.

This section treats of a ventilating fan and among other things provides that—

* * * the lessee shall not set same in line with the axis of any mine opening, but shall place same at a distance of not less than 15 ft. from the projection of the nearest side of such opening, and shall provide explosion doors of the full area of the airshaft or airway, in direct line with any and all such mine openings in order to protect said fan or other mechanical means of air circulation in case of a mine explosion. * * *

At many coal mines fans set in line with the main entrance have been demolished by the blast of an explosion, damaged beyond the possibility of repair, or so badly damaged as to cause serious delay. Offsetting the fan protects it and permits prompt renewal of the ventilating currents, so that men may be rescued who otherwise would be suffocated.

Anaconda Copper Co.'s Zinc Refinery Construction.

The new zinc refinery being erected by the Anaconda Co. at Great Falls, Mont., will be ready for operation early in September, unless there is unexpected delay in receiving the electrical machinery being made by the General Electric Co.

The buildings are completed and in readiness for the installation now of the electrolytic tanks. The zinc concentrator at Anaconda is nearly complete. The building is finished and all the machinery is on the ground and is being installed. If conditions required it, the concentrator could be completed and put into operation by Aug. 1.

The Anaconda Co. has its zinc mines ready to furnish 2000 tons of zinc ores per day to the concentrator on a few days' notice. This is the amount that the new plants are supposed to be able to handle. From these ores between 700 and 800 tons of concentrates can be made at the plant at the Washoe smelter and shipped to the refinery at Great Falls.

The Douglas mine is in fine shape with large bodies of high-grade zinc ore blocked out and ready for mining and shipping. The roads there are in poor shape yet but are being put into good condition. A haul of 12 miles from the mine to the railroad spur at Pine Creek is required.

At the Emma mine the new engine has been installed and sinking from the 800 level will begin within 30 days. Mining of zinc ores on the levels above the 800 can begin at any time.

The crosscut that is being run on the 1600 level from the Gagnon mine by the Anaconda Co. has still about 600 feet further to go to reach the point below the present bottom level of the Emma.

So far as we are aware, no copper ores are treated in the electric furnace in this country at the present time.

Missouri's Mine Output in 1915.

The value of the mine output of recoverable silver, copper, lead, and zinc in Missouri for the year 1915 was nearly $53,700,000, against $25,900,000 in 1914, according to a U. S. Geological Survey report. This increase was due to much higher prices and a larger output of zinc, lead, and copper. The production of silver decreased slightly and the value per ounce was less than in 1914. Approximately the value of the zinc increased $20,000,000, lead $4,760,000, and copper $65,000.

The demand for high-grade sphalerite concentrates induced the owners to reopen the sheet-ground mines and work them at full capacity. Prospecting was active in the soft-ground districts, but investors seeking properties preferred to purchase old properties which merely required pumping out and equipment, or new mines that had been so far developed that shipments could be made from them within a short time. The output of sphalerite from the sheet-ground mines increased 54%, but the sphalerite yielded from the soft-ground mines increased only about 7%.

The total production of sphalerite concentrates, all of which but 43 tons were derived from southwestern Missouri, amounted to 241,111 tons, valued at $18,382,520, an increase of 51,345 tons in quantity and of $11,030,794 in value compared with 1914. The quantity of sphalerite concentrates shipped from the Webb City-Carterville-Prosperity district increased 40,000 tons, and the value was $500,000 more than that of the total output of sphalerite from Missouri in 1914.

More smelters were in the market for zinc carbonate and zinc silicate ores, and the output of such concentrates increased from 19,648 tons, valued at $415,185, in 1914, to 25,412 tons, valued at $1,243,458, in 1915. This shows a value nearly three times that of 1914 and an increased production of 29%.

The recoverable spelter content of the zinc concentrates shipped in 1915 was 136,300 tons, against 105,994 tons in 1914. As the natural result of high metal prices the percentage of concentrates recovered from crude ore was much less than in previous years, and as the demand was greatest for high-grade concentrates the zinc assay of the concentrates increased. Sphalerite concentrates containing little or no lead were in special demand, and this condition is reflected in the lower grade of the galena concentrates from sheet ground mines in 1915. It was profitable to make a high-grade zinc concentrate having as small a lead content as possible, for there was a large margin in the base prices offered for high-grade, medium, and low-grade concentrates.

The total quantity of lead concentrates produced was 312,352 tons, 32,693 tons more than in 1913. The mines operating in the disseminated lead district in southeastern Missouri produced 278,104 tons of galena concentrates containing an average of 66.5% lead.

The Joplin region reported the sale of 34,248 tons of galena concentrates and 215 tons of lead carbonate concentrates in 1915, or about 3600 tons more than in 1914. As the increase in the Webb City district was about 7000 tons, it is apparent that there was a marked decrease in the output of lead from small and from "soft ground" mines.

The estimated total quantity of crude ore—lead, zinc, and copper—treated in Missouri in 1915 was 15,573,700 tons, about 4,100,000 tons more than in 1914. The quantity of dirt or ore from sheet ground mines treated in 1915 increased about 3,000,000 tons, that from soft ground mines 820,000 tons, and that from mines in the disseminated lead ore district in southeastern Missouri 350,000 tons.

The yield of silver and copper was derived mainly from the dressing of lead concentrates from mines in southeastern Missouri. The production of silver amounted to 57,756 fine ozs., valued at $29,282, a decrease of 3412 ozs. compared with 1914. The production of copper in 1915 was 402,160 lbs., valued at $70,378. The only mine in Missouri reporting production of copper ore was the Missouri-Copper Mountain Mining Co., at Sullivan, Franklin county, which produced oxidized ore carrying copper and silver.

Copper Imports and Exports.

Advance statistics prepared by the Bureau of Foreign and Domestic Commerce indicate total value of copper exports from United States was $13,328,026 in April, 1916, against $11,796,716 in April, 1915. Imports for April, 1916, were $8,685,287, against $2,417,923 in April, 1915. In exports a heavy increase occurred in refined ingots and a decrease in wire. In imports increases occurred in ore, refined, etc. Detail statistics follow in pounds:

Exports, April—	1916.	1915.
Ore, matte and regulus, etc.	366,741	1,604
Refined ingots, etc.	43,403,742	55,682,592
Plates and sheets	686,856	1,696,438
Wire	2,430,371	6,805,865
All other manufactures	.....	3,779,114
Total	46,887,710	67,965,613
Imports, April -		
Ore, matte and regulus, etc.	12,883,443	7,747,489
Refined, unrefined, etc.	28,984,011	11,378,410
Old, etc., for remanufacture	861,058	577,685
Composition metal	81,582	81,288
Total	42,810,094	19,721,872

Pounds exported fell from 67,965,613 in April, 1915, to 46,887,710 in April, 1915, and pounds imported increased from 19,721,872 in April, 1915, to 42,810,094 in April, 1916.

No amount of scientific knowledge of the causes of explosions will prevent accidents when ignorant and undisciplined miners are allowed to determine their own methods of mining and are trusted with unlimited quantities of explosives, whether in coal or metal mines.

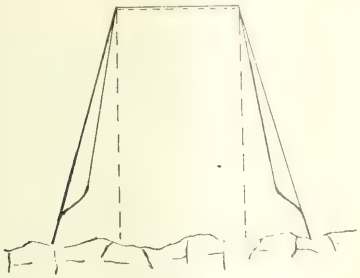
Copper exports from Atlantic ports for week ending June 8 were 9262 tons; since June 1 they were 11,232 tons, against 8723 same period last year.

Concrete Foundations for Mining Installations

By ALGERNON DEL MAR.

In the placing of mill foundations the engineer must consider strains due to static and dynamic forces. As in the use of alloy steel the dynamic forces, or those due to impact and vibration, are more important than those due to steady compression or tension, so in mill foundations the dynamic forces are the most important; in fact, these strains being far in excess of those due to the weight of the structure alone, instead of allowing a factor of safety of 3 to 6 as in ordinary structures, we must increase this many times to obtain a foundation that will stand the vibratory movements in stamps, tube mills or rock breakers.

The greatest compressive strains on the bearing surface on the top of a stamp-battery foundation of

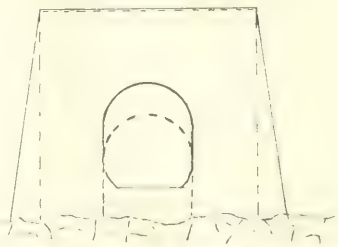


A. FOUNDATION ON BEDROCK.

average weight will not exceed 10 lbs. per sq. in., and on the bedrock base not over 4 lbs. per sq. in., while the usual mixture of concrete used will stand a compressive strain of 2400 lbs. per sq. in., or 240 (base 600) times that due to the weight of the battery alone. This may be considered to be a factor of 240. The Boston building laws allow pressures on concrete structures of not more than 55 lbs. per sq. in., while the City of New York allows 200 lbs. per sq. in. If we take the Boston limit we have then a factor of safety of 5½ above that allowed in that city, the stamp-mill foundation to stand vibratory strains while the Boston structures consider only compressive strains. Kent says that when the strains are of a complex character and of uncertain amount, a very high factor is necessary, possibly even as high as 40: he gives us to understand that unless the strength of the material is known and the forces it must withstand are likewise known, whatever factor of safety is assumed is a "factor of ignorance." So with concrete mixtures that must withstand dynamic strains, our factor of safety is a factor of ignorance, because we have no system of testing for concrete that will give an idea of the capability of the material for withstanding vibratory forces.

Without the aid of dynamic tests on cement and concrete it would be dangerous to apply any rigid rules, and all we can do at present is to make the best concrete possible for any foundation that must stand excessive vibrations, remembering that concrete in tension or shear is but 1/7 to 1/10 as strong as in compression. Our factor of safety therefore must be increased at least this amount above that due to compression alone.

In considering concrete foundations we must recognize the human factor plays a greater part than where steel or timber is used, for these latter products come to us with known qualities, while concrete has but one ingredient of the three that is known, and we must depend upon a proper selection of sand and rock, and the method of mixing and placing it to the judgment of some one who may or may not know the experiences of others. The failures in concrete structures are seldom failures due to miscalculations of compressive or tensile strains, but those due to vibratory forces, and result from improper proportioning, mixing and placing in the forms or from a poor bond between the machinery and the concrete, or the concrete and the bedrock. A and B will serve to illustrate the cause of many of the failures of concrete foundations, and applies equally to a stamp-mill mortar base, a tube mill or a rock-breaker base; these machines causing vibrations; the stamp mill producing them far in excess of any crushing machine we have. The dotted lines in A show a foundation that, while bearing the compressive strains of a machine with a big factor of safety, will develop weaknesses with a ma-

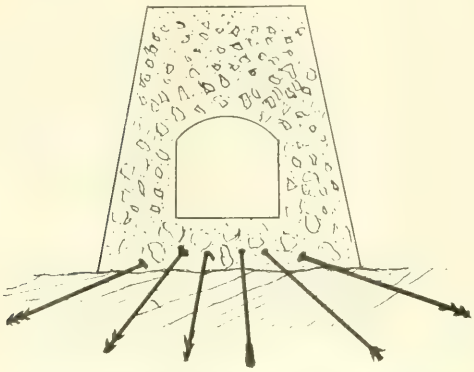


B. SHOWING HOLE THROUGH FOUNDATION

chine that sets up vibratory strains, the amount of movement in such a foundation, not keyed to the bedrock, increasing with the height of the foundation. With such foundations the base area must be increased by extending it as shown either by the inclined straight line or the curve. In B there is a hole through the foundation which in the dotted lines extends to the bedrock. By the addition of a small quantity of concrete the base area is increased by putting this hole

above the bedrock. This B foundation, having a wider base in relation to the height, need not be flared out as much as that of A. Both of these forms of structure to withstand dynamic forces must be keyed to the bedrock by rods cemented thereto.

If the foundation must repose on a clay or shale bedrock, means must be employed to increase the area of the base, both by flaring out the form of the foundation and by "fanning out" the rods so that they



C. FANNING OUT BEDROCK RODS IN LOOSE FORMATIONS.

give a grip over a more extended area. C illustrates the idea which was carried out successfully by the author and made a good solid foundation. The bedrock in this case was a stiff blue clay. These rods may constitute a part of the reinforcement and extend to near the top of the block.

The hold-down rods must be securely cemented in the bedrock, and will grip with greater tenacity if the ends are split with a wedge, barbed or upset. D represents the three most popular forms of rods, the barbed one being, in my opinion, the most satisfactory, for if made a little larger than the hole, while it may be forced down, it will not pull out. These barbs are made by cutting into the rod with a chisel and take but little time to prepare.

Sometimes foundations fail from lack of care in the selection of the sand and rock, even with proper geometrical form of structure. Here is the human factor again, and to guard against this class of failure the engineer should make blocks of concrete of the ingredients, and in the same proportion as he intends to use, and subject them to a test. It is all very well to say that this sand or that rock was used before with success; this is not sufficient. In this character of work one must be positive and not leave any factor to chance. If the sand has over 5% dirt, it must be washed or screened. If it is friable sand, do not use it. It is better to haul sand from a distance if the right quality can be found. In northern California in putting in concrete mortar blocks sand was hauled 6 miles up hill, while near at hand were many sand banks, but of inferior quality. This hauling paid, for the concrete was first-class, caused no delays for repairs and no breakages to machinery. If the rock is soft or friable, look for other rock that is firm and will stand breaking strains. As a chain is no stronger than its weakest link, so concrete is no stronger than its constituents.

A few examples of foundation failures will serve to illustrate the points brought out: A stamp mill mortar foundation failed because the mortar was put directly on the concrete without a pad of some sort to make a good joint. Carelessness in not keeping the foundation bolts tight allowed a little movement of the mortar, which gradually wore into the concrete, causing some delay in leveling the mortar and grouting cement under it. The repair was never satisfactory.

Another failure of a mortar base was attributed to the use of too much fine dirt in the sand; this fine material coming to the surface, and when dry breaking off while the interior of the block was as firm as could be wished. Outside of appearances this partial failure did no harm, but it showed that a more careful selection of sand would have given better results.

There are so many failures in concrete construction due to improper proportioning of the base in relation to side and end thrusts, or from not anchoring the block to the bedrock, that it would be useless to mention any specific examples; we have all seen them,

D. FOUNDATION RODS FOR HOLDING SUPERSTRUCTURES TO BEDROCK.

and yet while this is a fundamental requisite of all foundations, such mistakes continually occur.

An authority in the Platteville, Wis., district states that upwards of 20 large pumps of the general type installed by the Monmouth Zinc Mining Co., as described on page 1048 of the June 3 issue of the Mining and Engineering World, have been placed in service through the Platteville district. These are of the well-known Aldrich design and illustrate modern tendencies in the equipment of zinc mining and milling properties.

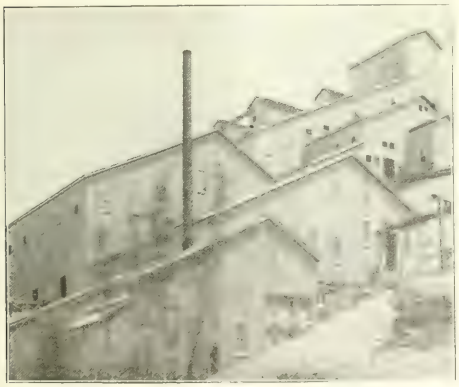
Chromium and tungsten are of the greatest value when alloyed with steel of a given analysis. The benefits are truly remarkable and it is not surprising that much is heard concerning high-speed steel as it is manufactured today.

Wolframite Mining and Milling at Wasp No. 2 Mine, Flatiron, S. D.

By Ed. M[illegible]

For years the Wasp mine has been noted for its low-grade gold mining. It has been known for a number of years that wolframite is present in this mine and about May 1, 1915, it was found in paying quantities. Since this time the company has mined 184 tons. This has averaged about 45% tungstic acid. Geologically the wolframite lies in flat formations, directly upon the lower Cambrian quartzite and sometimes mixed through the quartzite. We have found a little under the quartzite, between it and the underlying vertical Algonkian. In all cases it occurs along fissures in the quartzite.

The ore, after mined, is taken to the ore house and there sorted and cobbed. It is then crushed to about ½-in. and sampled and then sold to the highest bidder. For the first shipment which was made in July, we obtained $8 a unit for material carrying 48% tungstic



WASP NO. 2 MILL

acid. For the last shipment which was made in December we received $51 per unit for 47% tungstic acid.

We have recently constructed a concentrating plant to treat our low-grade ores. This ore is crushed to ⅛-in. mesh by rolls and from there through a trommel screen 16 mesh. The oversize goes to the jig and from there to a small set of rolls, returning to the trommel screen. The through product from the screens goes to a cone classifier from which the agitated slimes go to canvas tables and the sands to Wilfley tables. The sand from the Wilfleys go to a 4x5 ball mill, discharging into an 8-in. elevator which elevates and returns the reground sand to the classifier. The slimes go from the classifier to nine 4x60 ft. canvas tables which catch the concentrates, the slimes passing to a launder at the end of the tables and from there to an 8-in. elevator, which deposits the treated slimes into a 420-ton tank as tails. Here the tails which carry high in gold are treated by cyanide.

We are making three grades of concentrates, the first grade about 65% tungstic acid, the second about 45% tungstic acid, and the third, which are slimes from the canvas tables, runs about 35% tungstic acid.

*From Pahasapa Quarterly

Quicksilver in the Mazatzal Range, Arizona.

An examination of the quicksilver deposits of the Mazatzal Range, Ariz., has been made by F. L. Ransome, of the Geological Survey, and his report has been published as Bulletin 620-F. These quicksilver deposits occur in a strip of country about 6 miles long that extends northeastward across the Mazatzal range in the vicinity of Pine Butte, 11 miles south of North Peak. All the claims are in the Sunflower mining district, in which cinnabar was discovered in October, 1911, by E. H. Bowman, of Phoenix, while prospecting for gold.

Not enough mining work had been done at the time of the visit to determine whether the quicksilver deposits of the Sunflower district are susceptible of profitable exploitation. The geologic facts of occurrence and some sampling done by a New England mining engineer indicate that the parts of the lodes of minable dimensions now exposed to view carry no more than 3% to 4% quicksilver. When it is remembered that the New Idria mine in California, the largest producer of quicksilver in the United States, has for some years been making substantial profits on ore from which ½ to 1% quicksilver is obtained, it is evident that the Mazatzal deposits have considerable promise.

Facts that indicate the likelihood that the deposits will be productive are the undoubted persistence of the lodes for long distances over the surface and the lack of any evidence of decrease of ore with increase in depth. Too little has been done to prove that the lodes continue downward without diminution in content of quicksilver. The present transportation facilities are very poor and any plan for profitably working these deposits will have to reckon with the long wagon haul to Phoenix, Mesa, or Globe.

We are advised that, following initial reduction in a Telsmith gyratory crusher, the primary grinding of ore at the United Eastern mill in Oatman, Ariz., will be done in two No. 64½ Marcy ball mills, followed by Allis-Chalmers ball-pebble mills for the final pulverizing.

By using superheated steam there is obtained a fuel economy equal to half the steam saving. This means that the proportion of the heat imparted to a superheater is just twice as valuable, and generates just twice as much power per unit as heat imparted to a boiler.

Cost of Making Gasoline by the Rittman Process.

Government estimates show the cost of making gasoline by the Rittman process, based on a 5-tube plant, and the results of a 5-day run, with a recovery of 17% gasoline, and with varying prices of fuel oil, to be as follows:

The capacity of a single tube was 1.55 bbls. per hour or 37.2 bbls. for 24 hours. With loss, 10%, would yield 17% gasoline, the balance being fuel oil, as valuable as the original fuel oil.

The estimated cost of a 5-tube plant	$15,000
Estimated cost of building to house plant	5,000
Total	$20,000

Monthly capacity, 5580 bbls. Deducting about 10% for "shut downs" leaves net capacity 5000 bbls. Yield of gasoline 17%, 850 bbls., or 35,700 gals. Loss, 10%, equals 500 bbls. Residuum, 73%, equals 3650 bbls.

COST OF FUEL OIL $0.50 PER BBL.

Expense—	
5000 bbls. fuel oil at $0.50 per bbl.	$ 2,500.00
Labor for one month	560.00
Fuel (1050 M ft. at 15 cts.)	160.00
Electricity	100.00
Repairs	100.00
Interest and depreciation, 6% each	200.00
Refining cost, 20 cts. per bbl.	1,000.00
	$ 4,620.00
Credit—	
3650 bbls. residuum at 50 cts. (fuel oil)	1,825.00
Net cost—	
Net cost of 850 bbls. (25,700 gals.) gasoline	$ 2,795.00
Cost of gasoline per gal., 7.8 cts.	

COST OF FUEL OIL $1.00 PER BBL.

Expense—	
5000 bbls. oil at $1.00	$ 5,000.00
Labor	560.00
Fuel	160.00
Electricity	100.00
Repairs	100.00
Interest and depreciation, 6% each	200.00
Refining cost	1,000.00
Total cost	$ 7,120.00
Credit—	
3650 bbls. residuum at $1.00 (fuel oil)	3,650.00
Net cost—	
Net cost of 850 bbls. (25,700 gals.) gasoline	$ 3,470.00
Cost of gasoline per gal., 9.74 cts.	

COST OF FUEL OIL $1.47 PER BBL.

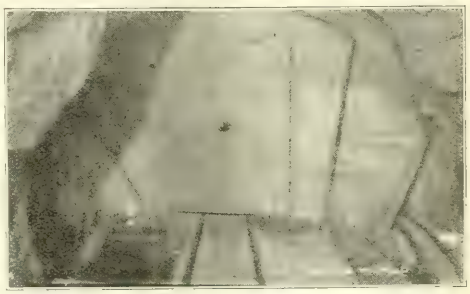
Expense—	
5000 bbls. oil at $1.47	$ 7,350.00
Labor	560.00
Fuel	160.00
Electricity	100.00
Repairs	100.00
Interest and depreciation, 6% each	200.00
Refining cost	1,000.00
[illegible]	$ 9,470.00
[illegible]	5,365.00
Net cost	
[illegible] gasoline	$ 4,105.00
[illegible]	

COST OF FUEL OIL $2.10 PER BBL.

[illegible]	$10,500.00
[illegible]	560.00
[illegible]	160.00
[illegible]	100.00
[illegible]	100.00
Interest and depreciation, 6% each	200.00
[illegible]	1,000.00
Total cost	$12,620.00
Credit—	
3650 bbls. residuum at $2.10 (fuel oil)	7,665.00
Net cost—	
Net cost of 850 bbls. (35,700 gals.) gasoline	$ 4,955.00
Cost of gasoline per gal., 13.9 cts.	

Fire Protection in Butte Mines.

Fires are always a great danger in any closely timbered mine, and in Butte mines special protection is provided. Fire doors are put in on each level in the crosscuts leading to the vein, and generally near the shaft stations. In this way the fire can be prevented from reaching the shaft. Fire doors are also placed along the principal drifts as well as in all connections that lead to other properties. Near the collar of the shaft a fire door is also put in. Generally the posts of the second set in the shaft are taken out, and a layer of concrete 12 ins. thick put in on top of the timbers of the shaft set. From this concrete as a base, concrete pillars are then carried up to catch the timbers above. The shaft fire doors, which are made of ⅜-in. iron, are carried by hinges set in the concrete over the wall plates of this shaft set and close down to meet in the center of the shaft, being shaped to fit tightly around the guides when closed. By means of ropes these shaft doors can be closed from the surface. A set below the fire doors, a 3-in. pipe perforated to



A FIRE DOOR IN A BUTTE MINE

act as a sprinkler, is carried around the shaft. This connects with the city water supply. The holes in this sprinkler are arranged to spray the water both inward and outward against the shaft timbers, so that a regular rain of water can be made to fall in the shaft and trickle down the timbers. Consequently, even should a fire reach a shaft station it can be kept from entering the shaft and damaging to any great extent.

The illustration herewith shows a concrete bulkhead across a drift with an iron fire door now in general use. In wet places the doors are of reinforced concrete, as they do not rust and corrode as do the iron doors. The pick and shovel for bedding down the track and preventing air from coming through under the door in case of fire can be seen. There is an iron casing for the door to lock against, and a rubber ring to guarantee tightness when the door is locked.

In sheet ground mines in the Joplin district explosives constitute one of the chief items of mining expense, varying from 20 to as high as 30% of the total cost.

Milling and Smelting at Humboldt, Arizona

By W. A. SCOTT.

The plant of Consolidated Arizona Smelting Co., Humboldt, Ariz., comprises a concentrating mill and smelter, both of which are operating at full capacity. The mill, which is equipped for concentration by tables and by oil flotation, is operated entirely on silicious sulphide ores from the Bluebell and DeSoto mines, owned by the company; while the smelter treats a considerable tonnage of custom ore and concentrates, as well as the company's smelting ore and mill product.

The mill is handling 270 tons per day of ore, sampling 3.25% copper, 10% iron, 0.03 oz. gold, 1 oz. silver, 65% silica. The aim is to receive at the mill only those ores on which a recovery of 90% or higher can be made. The operations for April showed a recovery of 94.3%, the concentrates product from tables and flotation machines running 9.53% copper, 0.1 oz. gold, 3 ozs. silver. The content of the flotation concentrates for April was 14.24% copper, 0.1 oz. gold, 3.8 ozs. silver, 26% insoluble. By weight, the table and flotation concentrates are practically equal, but in the recovery of copper the table product yields 30% and the flotation machines 70%.

THE BLUEBELL MINE OF THE CONSOLIDATED ARIZONA SMELTING CO.

CONSOLIDATED ARIZONA CO.'S SAMPLING PLANT AND CONCENTRATOR

Existing mill equipment consists of a 20x10 Blake crusher, two 40x15 rolls, Anaconda type, made by Allis-Chalmers Mfg. Co., by which the ore is reduced to 0.2-in. size. This product next passes to the mill feed bins, and down to this stage the work is dry crushing, and at this point wet concentration begins. By trommel classification the 0.08-in. undersize is passed to Wilfley roughing tables; the oversize being further reduced by two 8x36 Hardinge mills. The discharge from the latter joins the trommel undersize for table concentration. The table tailings are classified by a diaphragm cone classifier—the plus 65 being returned to Hardinge mill for regrinding, minus 65 passing to the flotation machine. The flotation machine consists of the standard type of Minerals Separation equipment, having 11 cells. This machine has 250 tons' capacity, in the operation of which 1 lb. of oil per ton of pulp is used, the oil being a mixture of 1 part by weight of refined wood creosote oil, and 3 parts fuel oil. The table and flotation concentrates are dumped together and conveyed to the smelter.

A new 12-cell oil flotation machine, of 600-tons' capacity, of Minerals Separation type, has been purchased and will be put in operation within a few weeks. In the meantime, the entire mill will be overhauled and in some respects re-equipped. A 6x6-ft. Allis-Chalmers ball granulator is to be put in, to follow the coarse crushing, and to precede the final grinding in Hardinge mills.

The smelting plant was increased in capacity in the last part of 1915, and is now equipped as follows: Two reverberatory furnaces, the dimensions of one being 100x19 ft., those of the other being 60x19, both connected with waste-heat boilers; one Wedge roaster; two copper converters, each 9x7 ft. 6 ins.; also a 40-ton Whiting electric crane, and ample blowers for the converters department. The blowing engines and air-compressors are steam-driven, steam from waste-heat boilers being utilized. The air compressor is used for atomizing the fuel oil in roasters and for general service. The charge capacity of the roaster is 110 tons per day, this consisting mostly of concentrates. The matter of further increasing the smelting equipment is under consideration. This may include a blast furnace as well as an additional reverberatory furnace. Two new Wedge roasters have been ordered.

The matte produced runs 26 to 30% copper; the slag produced runs 39% silica, 39.90 iron, 4 to 5% aluminum, and 0.35% copper. The plant treats about 350 tons per 24 hours of crude ore and 125 tons of

concentrates. The company's mill supplies 70 to 80 tons of concentrates per day, the balance of this 125 tons being custom concentrates. Of the 350 tons daily of smelting ore treated, about 200 tons are custom ores, of which the United Verde Extension, Jerome, and the Swansea mine, Yuma county, supply the greater part. The Swansea ore carries 3½ to 4% copper, this existing as sulphide of copper in a gangue of iron oxide; the iron in it runs 50%, sulphur 4.90%, insoluble 10%. Other ores received consist of copper-iron sulphides from Crown King district, copper ore in limestone from Grand Canyon, chalcopyrite from Copper basin, near Prescott, as well as some shipments from Wickenburg district and points on the Parker line of the Santa Fe.

The company's Bluebell mine, situated near Mayer, is operated through a 1000-ft. shaft, its ores running 3½% copper and $1.50 in gold and silver, The De Soto mine, at Middleton, near Crown King, is opened to a depth of 600 ft, by adit levels, shipments from same amounting to 120 tons per day.

The company employs a force of 380 men at its smelter, mill, sampler, two mines, and its offices. Geo. M. Colvocoresses, general manager, states that a new receiving and sampling plant are to be built. While the milling and smelting of the company's own ores constitute the big end of the work at the plant, under Mr. Colvocoresses' management the custom ore smelting has become a steady, increasing factor in the business. Among others on the operating staff are: E. C. King, superintendent of smelter; J. N. D. Gray, mill superintendent; J. C. McNabb, chief assayer and chemist.

Bookwalter-Dorland Ore Separator.

The Bookwalter-Dorland ore machine or separator and concentrator, is the result of several years of experimentation by the inventors, they having originally designed it for the purpose of recovering the gold values from river and beach sands, and placer gold deposits. But in the development of the machine it was also discovered that a good recovery was made of the values contained in the low-grade ores, including some of the most refractory, as well as from mill tailings. The process and operation of the machine (which is fully covered by patents) is an application of the jig and gravity principle, with the combination of pneumatic suction and agitation under the water. The machines, having a capacity of treating 50 tons of ore, or 200 tons of sands or mill tailings daily, require only 3 hp. for each machine with two men, and no chemicals, oil, or other elements, except air and water.

Ores, tailings and sands, containing in some instances not over 2% values, are reduced to concentrates that give most attractive returns. Mill tailings that have been run through the mill twice and gone to the tailing dump were afterward put through this machine, and zinc concentrates containing 44.6% zinc in paying quantities were recovered. Also from waste tailings of lead zinc carbonates two marketable products were obtained in zinc concentrates and lead concentrates. From a 3% wolframite ore, concentrates were produced containing 72.2% tungsten tri-oxide, and from a cinnabar ore, containing from ¼ to ½% quicksilver, concentrates assaying 50% quicksilver were obtained with no trace in the tailings.

A corporation has been formed to operate in Montana under the Bookwalter-Dorland patents. This company is capitalized for $1,500,000 and is composed of men in Helena and Great Falls, Mont., and several of Spokane, Wash.

The system adopted for the conduct of the business will be uniform in every state, and will be based upon the operation of the machines upon mine dumps and tailings, either acquired by purchase, or upon a royalty or percentage of profits of values recovered. No machines will be sold outright, but will in all cases be operated by, or under, the direction of the company. William A. Mears, Helena, Mont., is state representative.

New Colombian Mining Regulations.

Under a decree regulating the granting of concessions for the working of mineral deposits on public lands in Colombia, concessions restricted to an area of 3.86 sq. miles will be granted by that government for 25-year periods. Within 18 months of the approval of the contract the concessionaire must file with the Ministry of Public Works the precise location of his mine, plans of the workings, and samples of the mineral. A further period of 6 months is allowed in which to commence mining operations. The government claims the right to 15% of the gross receipts of the working and authorizes the concessionaire to erect all necessary buildings and to establish roads, light railways, cableways, telegraph and telephone lines, etc. Concessions granted to citizens of the republic may be transferred to aliens upon permission of the Colombian government.

New Company to Produce Ferromanganese from American Ores.—The U. S. Manganese Corporation was incorporated March 28 at Albany, N. Y., by W. R. Hopkins, M. P. Dalton, H. H. Meyers and others, to mine and smelt manganese ore. The mine is located at Elkton, Va., and comprises 1000 acres, which the new company owns or controls. For the past six months assembling, explorations and drillings on this property have been going on and large quantities of high-grade ores are claimed to be assured. Besides selling ore in the market the company has leased a blast furnace for producing ferromanganese. The enterprise has reached the stage where shafts are about to be sunk and ore can be turned out within 90 days. The original capital is nominal, but will be increased to a large amount. The company's offices will be located in New York.

Difficulties Encountered in Making Oil Flotation Tests.

By James McC[illegible]

Oil flotation has developed so rapidly during the past year that it has been found difficult for engineers and mining men to keep up with the subject. Testing ores for this process has become an important branch of study at many of the mining schools and a subject of research and investigation by the U. S. Bureau of Mines.

Those engaged in mining do not appreciate the importance of flotation tests or the difficulties encountered in working out problems in oil flotation.

In concentration tests we have known factors to work with, *viz,* size of particles and their respective gravities and suitable apparatus to separate the mineral from the gangue. The results of concentration tests can be observed by the operator, defects can be noted and improvements made.

In cyanide practice we have known reagents and their properties in dissolving metals which has been reduced to a practical science. The apparatus used in the cyanide process becomes a matter of choice and convenience in handling the pulp through the different stages of treatment.

In oil flotation tests we have no established factors governing the reagents used in this method; oils are used to produce a froth and as carriers and collectors of metals. Acids are required in many cases to clean sulphides and assist the oils in the production of a normal froth. At the present time there are over 100 oils and about 50 chemicals in the form of acids and alkalis used in making flotation tests. In many cases two or more oils and chemicals are combined to secure the desired results.

Many other conditions have to be considered in making oil flotation tests, such as the character of the ore, fineness of reduction, pulp and percentage of solids, temperature and froth conditions. The first consideration in a flotation test is to secure an oil or combination of oils and chemicals that will produce a froth containing the values and a clean tailings product. The results require many tests and patient investigation by the engineer. In some cases hundreds of tests have to be made before the right combination is found. Oils are extremely sensitive to acid or alkaline reactions and the chemical salts in the gangues of ores show a wide range of froth conditions that have to be carefully studied.

In order to secure the best commercial results by oil flotation it is *absolutely necessary to work out the right oil combination for a* [illegible] aptly stated, a particular oil for a particular ore.

Oil flotation practice indicates very clearly that concentration will be used extensively in connection with flotation. Table dressing will be necessary to recover the coarse values; combination tests have to be worked out to determine where table concentration ends and flotation begins.

The flotation engineer has troubles of his own and his patience tried to the limit when Mr. Mining Man sends in his samples for tests and expects a report the next day.

Oil flotation has reversed our general conception of ore dressing and it is sometimes difficult to explain why and how the results are obtained.

(1) In water concentration the heavy minerals find the lowest levels according to their respective gravities and the light material comes to the surface, while in oil flotation concentration the heavy minerals rise to the surface and the light gangues sink to the bottom.

(2) Standard practice by jigs and tables calls for coarse crushing and classifying, and every appliance known to the art is employed to avoid making slimes; in oil flotation practice fine crushing is necessary.

(3) Flotation tests are usually conservative and show lower recoveries than commercial practice. This is the reverse of laboratory tests in ore dressing as the tests are difficult to duplicate in practice.

Lignite Deposits Under Investigation.

With a view to a better utilization of the vast deposits of lignite in the west central and western states, the U. S. Bureau of Mines conducted a number of investigations into the economic methods of using these lignites. Bulletin 89, "Economic Methods of Utilizing Western Lignites," by E. J. Babcock, of the University of North Dakota, has just been issued by the bureau.

The author, in this bulletin, states that among the states having the largest workable deposits may be mentioned North Dakota, Montana, Wyoming, Colorado and Texas, and in several other western states lignite occurs in smaller areas. In North Dakota alone it is estimated that the deposits cover approximately 32,000 sq. miles, many of them being 10 to 15 ft. thick and capable of producing in all several hundred billions of tons of lignite.

When one stops to consider what these figures mean as to the immensity of these deposits in the west, it is not strange that people are seeking to ascertain better means for deriving larger benefits from the proper utilization of those great deposits. Consequently, any proposed methods of utilization that are promising are well worthy of careful consideration

The condition of the metallic impurities may have much influence. It is quite possible that the composition of different particles may vary according to the time in the distillation when they were condensed, or because of mixing of lots of dust of decidedly different composition. In a case of this sort, the precipitation test is the only simple method of determining what may be expected in actual work.

What the Mining Companies are Doing

Greene-Cananea.

According to its recently issued annual report, the Greene-Cananea Copper Co. received from dividends paid by Greene Con. and San Pedro companies $550,571. Expenditures were $44,531 and net $506,039. No dividends were paid, dividends being resumed Jan. 17 by payment of $1 a share.

Production of the mines and works owned and controlled by the company, including ores purchased, compares as follows:

	1915.	1914.
Copper, lbs.	16,335,081	21,858,920
Silver, ozs.	635,997	907,310
Gold, ozs.	3,773	6,055

The combined net income of subsidiary companies amounted to $1,410,543, equivalent to $2.82 a share on holding company stock, compared with $638,955 in 1914 or $1.27 a share.

The average price received for copper produced during the year was 19.566 cts. per pound, compared with 13.8382 cts. in 1914.

The total cost per pound for refined copper, after deducting values of precious metals and miscellaneous revenue, was 11.086 cts. per pound, including shutdown charges and general expense. Cost in 1914 was 10.724 cts. a pound.

The Cananea Con. Copper Co., all the shares of which are owned by Greene Con., produced last year 15,843,318 lbs. of refined copper at a cost, including all expenditures, of 10.940 cts. per pound. The price received was 19.541 cts. per pound. Operating profits for the year amounted to $1,362,605, after charging off all expenses of shutdown, etc. A dividend amounting to $500,000 was distributed during the year. Notwithstanding the interruptions and difficulties of operating mines and works which are located at Cananea, Sonora, Mexico, the company's surplus increased $862,605 during the period.

The combined income account of Greene Con. and Cananea Con. compares as follows:

	1915.	1914.
Total sales	$3,555,558	$3,281,073
Miscellaneous revenue	399,686	243,203
Inventory of copper	105,662	228,123
Total	$4,030,906	$3,752,998
Operating and general expense	2,156,178	2,887,954
Taxes	105,771	19,433
Depreciation	180,225	160,071
Inventory of copper at beginning of year	228,123	139,748
Net income	$1,362,606	$ 615,792
Dividends	500,000	1,000,000
Surplus	862,606	*384,208
Previous surplus	4,628,372	.....
Total surplus	$5,490,978	$4,628,373

*Deficit.

President L. D. Ricketts of the Cananea Con. says in part:

The period of political disturbances and war in Mexico continued throughout the year 1915. We succeeded, however, in operating the mines and works 151 days during the year.

The reduction works were started up in June, 1915, and continued in operation until Oct. 24, when the Villa forces took possession of northern Sonora and the works had to close down.

Work was resumed on the 10th of December and has continued up to the present writing (May, 1916).

Production follows:

[illegible] produced [illegible]	13,517,57[illegible]
[illegible] produced [illegible]	2,037,506
[illegible]	576,657 27
[illegible]	99,310 082
[illegible]	7,585 111
[illegible]	288 156

Recovery from domestic ores was: Copper, 2.307%; silver, 1.8274 ozs.; gold, 0.0115 ozs. Total cost, including ore mined under contract, was $2.4684 per ton.

During a portion of the time, conditions were exceedingly critical, and Americans were in a defenceless condition, but the operating force at Cananea succeeded by local effort in preventing destruction of property, and the most unfortunate circumstance was the murder of one of company's American employes. Company suffered a loss through forced payments, requisitions on our supplies and actual robbery in excess of $200,000. At the present time a firm government is established in Sonora, and the indications are that we will be able to continue uninterrupted operations in the future.

In spite of small amount of development done, the ore opened up has undoubtedly exceeded the ore taken out, and there were notably larger ore reserves at the end of the year than there were when we started up in June. The most important developments have been in the Sierra de Cobre and the Oversight mines. In the former workings in the vicinity of No. 2 shaft have opened up ore bodies of large size and the development is most encouraging.

The cost of producing refined copper for the year, including selling expense, was 10.940 cts.

Income account of San Pedro Copper Co., entire capital owned by Greene-Cananea and located at Cananea, Sonora, Mexico, shows total income of $176,906; expenditures, $128,968; net carried to balance sheet, $479,937, making total surplus Dec. 31, 1915, of $300,321; a dividend of $50,000 was paid to the Greene-Cananea.

Production follows: Copper, 791,763 lbs.; silver, 18,919.70 ozs.; gold, 106.273 ozs. Recovery per ton ore treated was: Copper, 2.63%; silver, 1.317 ozs.; gold, 0.006 ozs. Work was confined to the Sierra de Cobre property, 40% of which is owned by the San Pedro Co.

Granby Con., B. C.

At the June meeting of the directors of the Granby Con. Co. it is expected that action will be taken on the dividend to be paid in August, which is believed will be an increase over the present $6 a year basis.

Final figures for May will, it is expected, show a copper production in excess of 4,000,000 lbs. comparing with 3,950,000 lbs. in April. Based on 28-ct. copper the April earnings approximated $612,000, while total earnings for the first four months of 1916 were between $1,800,000 and $2,000,000.

Commencing in June the Anyox smelter will draw upon ores from the Midas mine in Alaska, where development work has been progressing for some time. The amount of production from the Alaskan property will, in all probability, depend very largely upon the operations at both Hidden Creek and Grand Forks. In brief, the Midas ores, owing to their richness, will be used largely as a "sweetener" in the general smelting operations of the company.

Development work at Anyox continues, as a result of which an increase in ore reserves will probably be shown in the forthcoming annual report. Actual production comes from a point 150 ft. or more above sea-level. Diamond drilling has been done down to 150 ft. below sea-level.

U. S. Smelting.

The U. S. Smelting, Refining & Mining Co.'s earnings for May totaled over $1,300,000, a record for the company. June is expected to do as well and probably better, so that with April's $1,200,000 the second quarter of this year should show profits of not far from $4,000,000.

Adding to the second quarter's estimate the profits of roughly $3,000,000 for the first quarter it is apparent that the company will show net to June 30 this year of about $7,000,000. This is from operation.

After interest charges on the notes and full reserves for depreciation and exploration and preferred dividends, the balance for the common for the first half year should be in excess of $15 a share. The company will earn a surplus after the payment of common dividends in the second 3 months of rising $3,000,000 as compared with over $1,800,000 in the first quarter.

Of the rising $7,000,000 earnings, it is interesting to note that only about $1,250,000, or 20%, will have come from Mexico. Not a ton of ore in the new Mexican development

has yet been mined, and it is not the intention to mine any for 6 to 10 months, as it will require at least that length of time to complete development work. Within 12 months, however, it is expected that a tonnage up to 25,000 tons or more per month can be obtained from the new property.

It is estimated that on 50-ct. silver, mining 10,000 tons per month, will mean an increase in net earnings of over $2,500,000. Similarly 20,000 tons per month would increase the annual earnings by over $5,000,000.

Alaska Gold Mines.

The May report of the Alaska Gold Mines shows 175,215 tons of ore milled, assaying an average of $1.40 per ton, against 94 cts. in April. The May report compares with preceding months as follows:

	Tons ore milled.	Assay value per ton.		Tons ore milled.	Assay value per ton.
May	175,215	$1.40	February	122,856	$1.02
April	165,930	.94	January	119,914	1.42
March	162,796	1.03	[illegible]	114,183	1.36

Extraction and loss in tailings shows as follows:

	% of [illegible]	Loss in tailings per ton.
May	82.85	24.0 cts.
April	[illegible]	10.8 cts.
March	77.47	20.3 cts.

Manager Thane reports: "The conditions set forth during the month of May are continuing to hold up and improve. The heads are very satisfactory. The tonnage will only be increased slowly until the No. 2 stope east on the fifth level is finished and the new stopes east on the sixth and seventh levels are still further advanced, so that the increase in tonnage can be made with proper proportions of ore drawn from all sections of the mine. The new stopes east on the sixth and seventh and all the new development work east on the fifth, sixth, seventh and ninth in the schist ore body are showing up good ore. The operation in all departments is in good shape."

Copper Range Co., Michigan.

The Copper Range Co. has filed with the Massachusetts secretary of state a statement of its financial condition, dated April 30, 1916, as compared with the same period ending in 1915:

	1916	1914
Assets—		
Real estate	$ 1,362,437	$1,362,416
Shares in Champion, Baltic, Trimountain and Atlantic Companies	[illegible]	[illegible]
Treasury stock	223,500	.....
Cash and debts receivable	1,943,896	806
Copper Range R. R. stock	1,941,900	[illegible]
Copper Range R. R. bonds	870,000	[illegible]
50,000 Champion shares at par		1,950,000
26,051 Copper Range R. R. at par		[illegible]
Total	[illegible]	218,323
Liabilities—		
Capital stock	[illegible]	300,000
Deposits from Baltic, Trimountain, Atlantic, Michigan Smelt. & Copper Range R. R. Companies	[illegible]	
Accounts payable	[illegible]	36,792
Receipts for copper	[illegible]	
Surplus	[illegible]	
Profit and loss	.....	[illegible]
Total	[illegible]	[illegible]

Miscellaneous Company Reports.

The Tonopah Extension Co. reports for the year ended March 31 as follows: Gross, $1,496,564; expenses, taxes, depreciation, $925,105; net profit, $571,459.

The estimated production and earnings of the Goldfield Con. Co. for May was 32,400 tons of ore mined, with net earnings of $52,000. This compares with 30,400 tons in April with net earnings of $60,000.

Old Dominion's smelter output in May was 3,500,000 lbs. of copper, a high record. Of this 3,000,000 lbs. represent the company's own output, the balance being from ores of Arizona Commercial and United Verde Extension. Barring accidents, Old Dominion should produce in 1916 not less than 35,000,000 lbs., which would also be a new record for the property.

The Copper Range Co., Houghton, Mich., has let a contract for an addition to the Baltic stamp mill, 270 ft. by 72 ft., completing the regrinding mill for this company. Construction on new addition starts immediately.

During the 5 months of 1916 Inspiration has a production record of 33,300,000 lbs. of copper and is now producing at the rate of 120,000,000 lbs. annually. An increased dividend is looked for at the next quarterly period.

May earnings of the Shannon Copper Co. were close to $100,000. Production is now running close to 1,000,000 lbs. of copper monthly. Net earnings for the 5 months of 1916 total $320,000. The company has a working capital of better than $500,000.

The production of the Shattuck-Arizona Copper Co. for May was as follows: Copper, 1,383,963 lbs.; silver, 25,865 ozs.; gold, 326 ozs. For the 5 months of 1916 output totaled as follows: Copper, 7,433,484 lbs.; lead, 1,611,957 lbs.; silver, 135,409 ozs.; gold, 2217 ozs.

The second quarter's profits of the Chino Copper Co. are estimated at $2,975,000, as compared with $2,746,986. For the first 5 months of 1916 production amounted to 27,289,792 lbs. of copper. Costs were 8.95 cts. per pound, as compared with 7.2 cts. for the fourth quarter of 1915.

President Knight states that profits of Iron Cap Copper Co. for April were $39,704, from which should be deducted amount expended on shaft construction and expenditures on account of new plant at westerly end of the property. Production was 228,355 lbs. of copper; cost, 10.661 cts. per pound; average price received, 28.04 cts. per pound.

The Greene-Cananea Copper Co. is producing copper at the rate of 66,000,000 lbs. of copper per annum. While actual operating costs have been lowered to a level comparing favorably with any that have gone before, the total cost of laying down Greene copper in the New York market will increase rather than diminish, owing to the burdens imposed by the unsettlement in Mexico. A fair estimate at the moment would be about 11 cts. a pound.

The American Zinc, Lead & Smelting Co. has arranged to purchase all the property and assets of the Granby Mining & Smelting Co. of Missouri. The latter, in addition to its mineral lands and smelters, has quick assets exceeding $2,750,000, of which nearly $1,000,000 is in cash. Its current liabilities are less than $300,000. From sales already made its net quick assets should amount to over $4,000,000. The purchase price of the property is $8,000,000. The net quick assets of the American Co. as of June 1 were approximately $7,000,000.

At the annual meeting of the Butte & Ely stockholders a resolution offered by the minority faction demanding that the $100,000 loaned to Giroux be demanded was voted down. Directors representing Cole-Cotton interests were elected. The annual report states that no mining or stripping was done in 1915. Proposed mining, concentrating and smelting agreement with Nevada Con. has not been consummated, as latter has been carrying on mining operations between Eureka and Liberty pits, and has not found it necessary to enlarge pit area and benches to south and west into Butte & Ely ground. The company is controlled by Consolidated Coppermines.

The May production of the Butte & Superior Co. was 54,100 tons of ore, from which 15,200 tons of concentrates were recovered. The total zinc in the concentrates is estimated at 16,150,000 lbs., or slightly less than April production. The showing for April and May indicates that zinc output for present quarter will be about the same as for first quarter of 1916. Recoveries for May are estimated at 93.1%. Silver produced was 310,000 ozs., or 15,000 ozs. less than in April. Lead production was 250,000 lbs. Manager Bruce announces that one of the two new shafts being sunk will be completed to 1500-ft. level by middle of July, affording large additional mining facilities. Good-sized ore bodies have been developed on the 1100-ft. level, both east and west of shaft in Jersey Blue claim.

MINING AND ENGINEERING WORLD

Published every Saturday by
MINING WORLD COMPANY, Monadnock Block, CHICAGO
Phone Harrison 2893

New York: 35 Nassau Street. Phone Cortland 7331.

Entered as Second-Class Mail Matter at the Post Office at Chicago, Illinois

LYMAN A. SISLEY . . . . . President
K. P. HOLMAN . . . . . Vice-President
C. A. TUPPER . . . . . Secy. and Treas.

SUBSCRIPTION PER YEAR
United States and Mexico, $3.00; Canada, $5.00;
By Check, Draft, Post Office or Express Order

ADVERTISING COPY
Must be at Chicago Office by 10 A. M. Monday to insure publication same week

CONTENTS.

Flotation Process at the Standard Mill, Silverton, B. C.*.. ..... *James G. Parmalee* 1121
Coal-Land Leases in Territory of Alaska 1124
Anaconda Copper Co.'s Zinc Refinery Construction 1127
Missouri's Mine Output in 1915 1128
Copper Imports and Exports 1128
Concrete Foundations for Mining Installation ..... *Algernon Del Mar* 1129
Wolframite Mining and Milling at the Wasp No. 2*..... ..... *E. D. Mannon* 1131
Quicksilver in the Mazatzal Range, Ariz. 1131
Fire Protection in the Butte Mines* 1132
Cost of Making Gasoline by the Rittman Process 1132
Mining and Smelting at Humboldt, Ariz.*..... *W. A. Scott* 1133
Bookwalter-Dorland Ore Separator 1134
New Colombian Mining Regulations 1134
Difficulties Encountered in Making Oil Flotation Tests.... ..... *James McClure* 1135
Lignite Deposits Under Investigation 1135
What the Mining Companies are Doing—
Greene-Cananea; Granby Con.; U. S. Smelting; Alaska Gold; Copper Range; Miscellaneous 1136
Editorial—
Present Copper Demand and Future Market Control.... 1138
Alaska: Its Present and Future 1138
Trade Stability Founded Upon Mine Output 1139
Personal 1140
Obituary 1140
Schools and Societies 1140
New Publications 1140
Type CI Slip-Ring Induction Motor* 1141
Senn Concentrator Installations 1141
Trade Publication 1141
Industrial and Trade Notes 1142
Patents Relating to Mining 1142
General Mining News
Alaska 1143
Arizona 1143
[illegible] 1144
Colorado 1145
[illegible] 1146
Idaho 1146
[illegible] 1147
Michigan 1148
Montana 1148
Nevada 1149
New Mexico 1150
Oregon 1151
Utah 1151
Washington 1152
Wisconsin [illegible] 1152
Wyoming 1153
Canada: British Columbia, Ontario. 1153
World's Index of Current Literature.. 1155
Metal Markets and Prices-Current.. 1160
Dividends of Mines and Work 1162

*Illustrated.

Present Copper Demands and Future Market Control.

The copper market was enlivened by rumors that large buying of American copper by Europe is pending. It is claimed that inquiries are in the market for more than 200,000,000 lbs. It is known that over the last week a fairly large tonnage was sold for shipment abroad. Before the war Germany purchased at the rate of 500,000,000 lbs. of copper annually from the United States. Since the war it has been able to get little. Germany and Austria are expected to be the big sources of immediate outlet for copper after the war.

There is a rumor that will not down that there is an organized effort under way looking to the placing of the United States in position to regulate the copper market of the world. Previous to the big war, London was the largest factor in the copper market, notwithstanding that most of the world's copper was either produced or refined in the United States. To most producers it would seem entirely appropriate that this country should dictate the course of the world's copper market.

It is currently reported that an agreement has been entered into whereby copper will hereafter be sold for export at a stated price. Foreign buyers heretofore have been using prices of one agency against another in order to force prices down. The above agreement, if carried out, will prevent such practices in the future.

In our issue of May 8, 1915, we called attention to the statements of D. C. Jackling, censuring American producers for selling their copper assets, which can never be replaced, at a paltry profit of 2 or 3 cts. a pound, for which the next generation may pay dearly, and this, too, despite the fact that the American producer is supreme in the copper mining industry.

A get-together movement along the above lines is to be commended and should result in a sane control of copper metal selling prices.

Alaska: Its Present and Future.

Year by year the extent and richness of the Alaska mineral zone is proven by exploration and development. Operations have assumed magnitude and great capital is being invested in mining and milling operations. The variety of ores, including the precious metals, includes nearly every known mineral of all the other mining countries of the world. Add to its output of gold its vast resources in coal and copper, not to mention tin, tungsten, petroleum and numerous other metals, and we open up a prospect of future development whose vastness can hardly be realized and is as yet but faintly guessed at by the world at large.

The age of the argonauts, however, is over and the country has settled down to a steady poducing basis. The prospector will still be found, as he is everywhere where the lure of mineral wealth attracts him, but he

will no longer be the conspicuous feature of Alaska's mining life.

There is a quite prevalent belief that Alaska is frozen up most of the year. As a matter of fact, a large part of the mining regions have a climate like that in Maryland and northern Virginia. Alaska has really a better climate than that of an equal area in the northern parts of Europe, where fully 10,000,000 people live in comfort. Alaska is one and a half times the area of the original 13 states of the Union. Its coast line is 23,000 miles. It has a region of rich arable land that is the equivalent of the areas of New York and Pennsylvania. Alaska will be greatly helped this year by improved railroad and water communications.

Some idea of Alaska's great mineral riches may be formed when the recent dividend of the Kennecott Copper Corporation is considered. Despite the strangling of Alaska's development by the so-called conservation policy of the government, this company was able to make a quarterly dividend disbursement of approximately $4,200,000, or at the rate of nearly $17,000,000 a year. This is equivalent to two-and-a-half times what this government paid to Russia for all Alaska. It is expected that Alaska will produce nearly $40,000,000 worth of copper in 1916, a sum five-and-a-half times its purchase price.

The value of the mineral production of Alaska in 1915 amounted to $32,854,229—$13,788,563 more than the value in 1914 and far more than that of any previous annual output during the 36 years that mining has been carried on. The collection of mineral statistics of Alaska for 1915, just completed by Alfred H. Brooks of the Geological Survey, shows that the value of the gold produced during the year amounted to $16,702,144, copper $15,139,129 and silver $543,393. Tin, lead, antimony, marble, gypsum and a small amount of petroleum and coal bring the total value of Alaska's mineral products to $32,854,229. Since 1880, when mining first began in Alaska, the territory has produced gold, silver, copper, tin and other minerals to the value of $300,953,751, the gold production alone to the close of 1915 amounting to $260,858,943. Of this gold $186,192,992 worth was produced by the placers, the rest being derived from lode deposits.

Mining operations the present year will be on a much larger scale than ever before and it is the general belief that the country will improve in productiveness when other mineral zones are worked out.

Trade Stability Founded Upon Mine Output.

It has been wisely said that the United States has never suffered from a serious trade depression when the farmers were prosperous. It does not require a sage of wisdom to supplement that truism by coupling the farmers' prosperity with the increment of the mines. About three score of years ago (to be exact, in 1886) the annual gold production of the world had reached $100,000,000. From that year until now the output has increased to approximately $465,000,000. In this period the population has increased 35 to 40%. Commercial operations have just about kept pace with the increase in gold. Commercial expansion has created greater markets and has proportionately increased the demand for foodstuffs.

The connective analogy between farm prosperity and mine output is clear. The addition of silver to the world's wealth is not taken into consideration in these calculations, but it assists mightily. The real stability of the nation's prosperity is gold. Upon this foundation is builded industrial enterprise. Upon this basic strength is commerce expanded and made certain. From the volume of gold comes the energy which makes markets for produce. And upon gold resources the credit of business, in individual or corporate capacity, depends. Business operations, large and small, are conducted upon credit, but there must be absolute security behind credit, and that security comes from the "coin of the realm," which in turn comes from the mines. Other metals and minerals and precious stones are commodity. Gold fixes the value of commodities.

Thus, the intimate and undiminishing connection between commerce, industrial activity, agriculture and credit is a fourfold tie that binds the prosperity of the country. The increase of one depends on the fixidity of the others. The success of all makes the concrete strength of the nation. As these four elements of prosperity are interdependent, so like a great marble shaft whose durability must be in proportion to the strength of its foundation, commerce, agriculture and credit must have its foundation secure; and that base is gold, and our mines are making a larger and stronger base every year.

The Utah Copper Co. will enlarge its milling capacity to the extent of an expenditure of $2,500,000. This on top of dividend disbursements during the first half of 1916 amounting to $8,934,695, and with a working capital of $16,000,000 at the end of the quarter, shows to what extent American copper companies have been benefited by the high price for the copper metal. At its present rate of production—[illegible] lbs. per annum at a cost of 7 [illegible] cts per pound, Utah Copper will have a net revenue of $35,000,000; Nevada Con. earnings will increase this total to approximately $42,000,000. With the additions planned completed an output of 200,000,000 lbs. annually is possible.

Nowadays, makers of mining machinery usually maintain testing plants for the demonstration of their own devices, where prospective customers can test their ore under the supervision of their own engineers or representatives. The comparisons that can thus be made leaves little opportunity for serious error in mill construction, a condition of affairs decidedly dissimilar to that of but a few years ago.

PERSONAL.

C. W. Newton, general manager of the Interstate-Callahan Co., Wallace, Idaho, has been in Butte, Mont.

F. E. Mariner, Pensacola, Fla., representing a company manufacturing flotation oils, is now in Goldfield, Nev.

J. H. Kerns, general manager of the Hypotheek Mining Co., Wallace, Idaho, has returned to his home at Moosejaw, Sask., Canada.

Henry Krumb, who has been in South America for the past 6 months inspecting the Braden Copper property, has returned to New York.

William Dobbins, formerly engineer at the Seneca-Superior mines, Cobalt, Ont., now has charge of the Good Luck property, near Arnprior, Ont.

Frank L. Culver, president of the Temiskaming Mines Co., Cobalt, Ont., has recently been elected a director of the Schumacher Mines Co., Porcupine, Ont.

Webster P. Cary has resigned as superintendent for the Atlas Mining & Milling Co., Ouray, Colo., to accept a position with James M. Callow, Salt Lake City, Utah.

Charles S. Herzig, consulting mining engineer, New York, is in Salt Lake City, Utah, and has recently completed an examination of the Emma Copper Co.'s property.

E. M. Rabb is now superintendent of the Tom Reed mine, Oatman, Ariz. He was formerly superintendent of the Gold Road and Tennessee mines in the same district.

Charles D. Laing, president of the Rescue-Eula Co., Tonopah, Nev., has returned to his headquarters at San Francisco, Cal., from a trip of inspection to the mines.

E. E. White, for 7 years chief geologist with the Cleveland-Cliffs Iron Co., Ishpeming, Mich., has resigned to go to Sakchi, India, as geologist for the Tata Iron & Steel Co.

H. H. Dyer and Everard Leland, superintendent of mines and chief mining engineer of the Shannon Copper Co., Metcalf, Ariz., have been in Globe, Ariz., examining mining property.

E. W. Berry, professor of geology Johns Hopkins University, has been engaged to do special geological work during the summer in Texas and Mississippi for the U. S. Geological Survey.

OBITUARY.

Charles Sweeney, organizer of the Federal Mining & Smelting Co., Wallace, Idaho, died recently in Portland, Ore. The majority of his mining operations had been in the Coeur d'Alene district, Idaho, to which place he went with the gold rush of 1883. His first location was as a merchant at Eagle, Idaho. He then removed to Wardner, where he owned and operated the Last Chance mine. He took hold of the ground as a prospect, drove the Sweeney tunnel through the mountain and brought the property to the producing stage. In the rush to the Buffalo Hump district, near Concord, Idaho, he acquired the Big Buffalo property. Through litigation he finally obtained the property at $200,000 and it is estimated that he put about $900,000 into its development. His greatest success, however, was in organizing the Federal Co.

SCHOOLS AND SOCIETIES.

California First Aid and Mine Rescue Field Meet.—The second annual California First Aid and Mine Rescue Field Meet will be held at Sacramento, Cal., on Wednesday afternoon, September 6, 1916. This meet will be held under the auspices of the California Metal Producers' Association, assisted by the Industrial Accident Commission and the U. S. Bureau of Mines. A committee on arrangements has been appointed and every effort will be made to make the affair an interesting one. Sufficient judges will be secured and a method of judging adopted that will reduce to a minimum any reasons for complaint on the part of the contestants or spectators. Suitable and desirable prizes will be provided in the form of cash, medals, cups and merchandise. As soon as the judges are selected, rules governing the contest will be sent to all teams which have been entered. Also, a list of practice problems will be submitted. The meet will include a contest in first-aid-to-the-injured and also a contest in mine rescue work, which shall embrace the use of oxygen-breathing apparatus. Entries should be sent at the earliest possible date to Robt. I. Kerr, secretary, California Metal Producers' Association, 1109 Merchants National Bank building, San Francisco. No entries will be accepted after August 1, except by unanimous consent of the committee on arrangements.

NEW PUBLICATIONS.

Coals of the North Fork of Kentucky River in Breathitt and Perry Counties. By James M. Hodge. Frankfort, Ky., State Geological Surv. Series IIII; Volume III; pp. 409.

The area herein covered is subdivided in three ways in most instances and in some few there are four subdivisions. This elaborate subdivisioning has made it possible to give a very complete description of the different beds. In each subdivision the bed which outcrops, or is known to exist there, is described and the nature of the bed and thickness given. The report is completed with 33 pages of tabulated information, which includes analyses of the several coals found in the area.

Summary Report of the Geological Survey, Department of Mines, Canada, for 1915. Ottawa, Ont., Canadian Geological Survey. Report No. 26; pp. 307; illustrated. For sale by Mining World Co., 35c.

This is the customary annual report gotten up by the department and includes reprints of the findings and reports made on various subjects and areas during the year by the several divisions of the Survey. These divisions are the geological, topographical, biological, anthropological, geographical and other more minor divisions. The reports are reproduced in detail and vary in length from a few pages to 30 or 40 pages.

Mineralogic Notes, Series III. By Waldemar T. Schaller. Washington, D. C., U. S. G. S. Bulletin 610; pp. 164; illustrated.

There are six practically new minerals taken up in this bulletin in detail. Less important mineralogical discoveries in regard to peculiarities of minerals already known are also given. Included in this information is a fair description of the alunite found in the deposits at Marysvale, Utah, where considerable attention is now being centered on account of the aluminum and potassium which the mineral contains. Many illustrations and halftones are shown and with the many detailed results of investigation, make the bulletin especially important from a mineralogical point of view.

Geology and Ore Deposits of Rossland, British Columbia. By Charles W. Drysdale. Ottawa, Ont., Canadian Geological Survey. Memoir 77; pp. 317; illustrated.

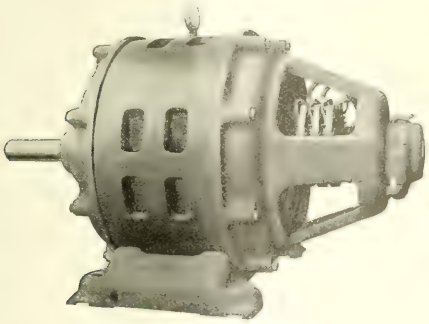
The memoir is divided into two parts. Part I is on that geology which is of economic aspect of the subject or closely affiliated with the formation of the country and its ore bodies. Under general geology the lithology of most of the rock formations is given and followed by accounts of the geological structures, faulting, etc. Under economic geology a lengthy talk is given on the genesis and nature of the ore deposits and formations closely affiliated therewith and this is supplemented by considerable of the mineralogy of the ore deposits and formation. The last 80 pages of the first part contain descriptions of most of the mines of the district. Part II is of little importance from a mining point of view and deals entirely with the physiography of the country.

Progress Made in the Manufacturing Industries

Type CI Slip-Ring Induction Motor.

A new line of slip-ring induction motors (type CI), for severe, intermittent, varying speed service has been developed by the Westinghouse Electric & Mfg. Co. of East Pittsburgh. These motors are especially designed for heavy duty on cranes, hoists, bridges, railway turntables, transfer tables and similar applications. They are furnished in sizes from 1½ to 200-hp. for operation on 2 or 3-phase, 220 or 440-volt, 25 and 60-cycle circuits.

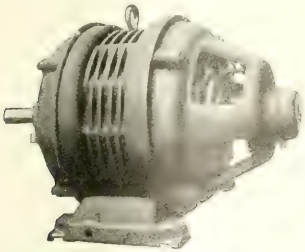
The frames of the smaller [illegible] steel



MOTOR SHOWING [illegible]

laminations riveted between forged steel and shields; in the larger sizes the frames are made of rolled open-hearth steel. The brackets are of cast iron with reinforcing ribs to assure rigidity and perfect alignment of the bearings at all times. The bearings are self-oiling, of the oil-ring type, and are large in size. The steel brush holders are supported by and insulated from the bracket, which is open to permit easy inspection and renewal of the brushes

The rotor is small in diameter, thus reducing the fly-wheel effect. This feature, together with perfect balance and secure attachment of the windings, makes these motors espe-



SHOWING BUI[illegible]

cially adapted for frequent starting, stopping and reversing. The shaft is of axle steel and can be removed from the rotor without disturbing the windings.

The running torque of these motors is the maximum obtainable and the starting and pull-out torques in all motors exceed twice full-load torque. They are so constructed, that in case of accident, repairs can be quickly made, and maximum strength is obtained while weight and overall dimensions have been reduced to a minimum.

The illustrations show a 75-hp. motor, with rolled steel frame, and a 10-hp. motor with built-up frame construction.

Senn Concentrator Installations.

E. H. Shackelford, whom many of the visitors to the Panama Pacific Exposition will recall having met at the exhibit of the Senn Concentrator Co., has recently been conducting extensive experimental work in the field, having finished a large number of tests at the Morenci mill of the Detroit Copper Mining Co., and having installed Senn concentrators at the Copper Queen mill at Bisbee, Ariz, the Bunker Hill mill at Tombstone, and elsewhere. In February Mr. Shackelford carried out a series of tests for the Old Dominion Copper Mining & Smelting Co. at Globe, Ariz., using the Senn concentrator to handle the fine sand discharge from Allen cone classifiers, as a result of which the Old Dominion ordered Senn concentrators. Mr. Shackelford spent the month of April at Tyrone, N. M., erecting and starting the 30 Senn concentrators in the first 1000-ton unit of the Burro Mountain Copper Co.'s new plant. Since the first of May he has been conducting further tests, at the Morenci plant of the Detroit Copper Mining Co., whence he will go to Ruby, Ariz., to erect concentrators for the Oro Blanco and then to the Oceanic Quicksilver mine at Cambria, Cal., to make tests of the Senn table handling cinnabar. Communications from mill managers desiring similar experimental work carried out will reach Mr. Shackelford in care of N. E. Otterson, 607 First National Bank building, San Francisco.

TRADE PUBLICATIONS.

Metallic Air Pump Packing. United States Metallic Packing Co., Philadelphia, Pa. Pamphlet; pp. 4; illustrated.

Features of this kind of packing are spoken of and sectional views, accompanied with descriptions, and shows how the packing is used, its nature, and place where used.

Telephone Apparatus and Supplies. Western Electric Co., New York. Catalog No. 3; pp. 404; illustrated.

This catalog is not confined to any class of telephones and accessories peculiarly adapted to any particular work, but is both general and complete. It includes equipment, tools, arrangement of systems, etc., for almost any class of service or work. It is well indexed and each piece of equipment has an illustration, description, details and prices of the same being given. As much of the information as possible is given in tabulated form.

Suspension Cableways and Aerial Trams. S. Flory Mfg. Co., Bangor, Pa. Catalog; pp. 90; illustrated.

This catalog is accompanied with a booklet giving an account of "S. Flory Mfg. Co.'s Products Used in Building the Kenisco Dam, N. Y." In the catalog proper a reprint of a paper on "Suspension Cableway Construction" is given. Many illustrations, with brief descriptions, are then given, showing the company's equipment in practical use, at quarries, open pits, etc. Boilers, winding machinery and accessories are cataloged in the last pages. Tables of details and descriptions with illustrations are reproduced in each case.

Electrically Driven Air Compressors. Ingersoll-Rand Co., New York. Bulletin Form No. 3026; pp. 40; illustrated.

Duplex air compressors which are direct connected and electrically driven and named by the company "Ingersoll-Rogler Class PRE" compressors, are gone into in detail in this bulletin. Separate views, sections and drawings are given of the separate parts and assembled compressor. The general features and construction of the compressor are first reviewed and this is followed by a more detailed description of its construction and operation. To make possible the use of higher speed motors and thus more speed in the operation of the compressor the company has paid considerable atten-

tion to the design of the valve and cooling parts of the compressor. It is stated that they have brought out many other new features, but the above are foremost, since the slow speed of the motors required in early designs of this nature was the cause of trouble in direct connection with motors.

Crushers for Limestone, Coal, Etc. The Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. Catalog; pp. 28; illustrated.

The catalog is completely indexed and treats on a line of crushers particularly adapted to the crushing of limestone, coal and other similar materials. It differs from many other types in that a hinged hammer is used for the crushing and is made to strike by the revolving of the shaft to which they are attached. The catalog states that one of their endeavors has been to make the machine as adjustable to wear as possible. Considerable discussion is had regarding the reasons why this type of machine excels and its construction is explained in fair detail. Each type is shown in section and is supplemented with a description and table of details for that particular machine.

High Pressure Tanks for Air, Gas and Liquids. Wm. B. Scaife & Son Co., Pittsburgh, Pa. Catalog; pp. 24; illustrated.

Tanks for containing fluids under pressure and adaptable to many different uses are included in the catalog. The several types are first described as regards their construction and particular uses. This descriptive matter is then followed by several tables in which detailed sizes and the corresponding prices with the capacity are given. Classes of tanks included in this catalog are: Brazed pressure tanks, riveted and brazed air receivers, brazed pneumatic and water supply tanks, riveted pneumatic pressure tanks and standard and extra heavy storage tanks.

Crushing, Grinding, Screening and Mixing Machinery. Sturtevant Mill Co., Boston, Mass. Catalog 79; pp. 31; illustrated.

The construction and theory regarding the crushing principles of the company's mill are gone into in fair detail. A ring, inside of which are three supported rolls, is made to revolve. The material to be crushed is held to the ring by centrifugal force and in being drawn under the three rollers by the revolving ring is crushed. It is stated that any kind of solid material can be handled as large as 1½ ins. and the product varied from 8 to 200 mesh in some instances. The mills are constructed in both duplex and single roll types, making five different sizes of machines. The largest, when crushing phosphate rock, handled 24 tons per hour with the product from 60 to 80 mesh and the smallest in handling various materials from 1 to 3 tons per hour. There is a supplement to this catalog, "Elevators for Ring-Roll Mills."

INDUSTRIAL AND TRADE NOTES.

The Oliver Continuous Filter Co., San Francisco, is in receipt of an order for two filter units, each of 150 tons capacity, from the Furukawa Mining Co., Tokyo, Japan.

The E. H. Moyle Engineering & Equipment Co. has removed its offices to 508 East Ninth Street, Los Angeles, where will be shown and demonstrated the company's products. Laboratory and metallurgical tests will also be made.

The Traylor Engineering & Manufacturing Co., on account of the increasing demand for its equipment, has under way an increase of its shop capacity, which, when completed, will nearly double its output. Already under con- [illegible] 30x400 ft., for small tools, etc. Among the new buildings and additions is a 110x112 ft. addition to the plate shop; a warehouse 75x188 ft. and four stories high; a rearrangement of the trackage system, etc.

PATENTS RELATING TO MINING.

Mine Lamp. William McKean White and Everton C. Brommer, Indianapolis, Ind., assignors, by mesne assignments, to Electric Service Supplies Co., Philadelphia, Pa. (1,183,147; filed July 6, 1915.)

Mining Machine Moving and Holding Device. Edmund C. Morgan, Morgan Park, Ill. (1,183,102; filed June 27, 1910.)

Process of Cyaniding. Harai R. Layng, Seneca, Cal. (1,183,086; filed Dec. 29, 1914.)

Dumping Car. Albert C. Murphy, New York, N. Y. (1,183,027; filed March 20, 1914; renewed Oct. 15, 1915.)

Process of Desulphurizing Ores. Howard F. Wierum, Upper Montclair, N. J., assignor to the Sulphur Syndicate, Ltd., London, England. (1,182,951; filed Dec. 29, 1914.)

Mine-Check Holder. William A. Williams, Barton, Ohio. (1,182,953; filed April 20, 1914.)

Hoisting Machine. Joseph Alexander Butterworth, Loughborough, England, assignor to Herbert Morris, Ltd., Loughborough, England. (1,183,429; filed Sept. 26, 1914.)

Dry Ore Separator. David M. Owings, Canton, and William R. Kinsey, Bartlesville, Okla. (1,183,226; filed Dec. 16, 1915.)

Combined Tamper and Charger. William Frost, Tallula, Ill., assignor to John C. Boeker, Tallula, Ill. (1,183,290; filed March 1, 1915.)

Safety Apparatus for Mine Hoists. Daniel F. Lepley, Connellsville, Pa. (1,183,306; filed Sept. 28, 1914.)

Building Tunnels. Emil Diebitsch, Nutley, N. J. (1,183,352; filed April 4, 1914.)

Fluid-Pressure-Operating Mechanism. Omar E. Clark, Denver, Colo., assignor to the Denver Rock Drill Manufacturing Co., Denver, Colo. (1,183,275; filed April 24, 1915.)

Steam Pump or Air Compressor. Kennedy Dougan, Minneapolis, Minn. (1,183,175; filed Jan. 16, 1909.)

Acid-Reclaiming Apparatus for Sulphite-Mills. George S. Witham, Sr., Hudson Falls, and James J. McEwen, Fort Edward, N. Y. (1,183,152; filed Dec. 11, 1915.)

Process of Refining Copper. Edward C. King, Cananea, Mexico. (1,183,736; filed Oct. 22, 1910.)

Rock Drill. August M. Becker, Toronto, Ontario, Canada (1,183,827; filed Dec. 18, 1913.)

Conveying and Weighing Mechanism for Charging Machines. Henry A. Carpenter and Arthur W. Warner, Sewickley, Pa., assignors to Riter-Conley Manufacturing Co., Pittsburgh, Pa. (1,183,797; filed July 7, 1914.)

Washing System. Hiram S. Downerd, Richmond, Ind. (1,183,805; filed Feb. 4, 1915.)

Stamp Mill. Frederick Bassett, Philipsburg, Mont. (1,183,521; filed May 18, 1915.)

Compound for Treating Sulphur-Bearing Fuel and Other Substances. Charles Foxwell, Baltimore, Md., assignor to the Smoke-Coal Economizer Corporation, Baltimore, Md. (1,183,445; filed Feb. 19, 1916.)

Oil Distillation. Samuel M. Herbel, Inza, Mo. (1,183,457; filed Dec. 7, 1915.)

Tube Mill. David E. Carlson, Chicago Heights, Ill., assignor to Chalmers & Williams, Inc., Chicago Heights, Ill. (1,183,431; filed July 14, 1915.)

Suction Valve for Compressors, Engines, Pumps, and the Like. James John Smith, Brisbane, Queensland, Australia. (1,182,937; filed May 5, 1915.)

Process of Recovering Elemental Sulphur from Sulphur Gases. William Francis Lamoreaux, Isabella, Tenn. (1,182,915; filed June 19, 1915.)

Separation of Metallic Sulphides. Leslie Bradford, Broken Hill, New South Wales, Australia. (1,182,890; filed Sept. 10, 1913.)

Mine-Car Running Gear. Warren V. Johnson and Robert C. Kepner, Bloomsburg, Pa., assignors to American Car & Foundry Co., St. Louis, Mo. (1,183,983; filed Nov. 22, 1915.)

Late News From the World's Mining Camps

Editorial and Special Correspondence.

ALASKA.

Seward.

The Department of Interior has announced that the coal fields of Bering river and Matanuska fields may be leased and applications for leases will be accepted until June 30. They may be awarded by the secretary of the interior "through advertisement, competitive bidding, or other methods he may by general regulation provide." It is decided that each application received this month shall be advertised for 30 days, following July 1, by number, applicant's name, and by description, with the statement that the lease is to be awarded subject to such better bids for the particular tract advertised. Areas of leasing units vary in size from 320 to 1280 acres in Matanuska, and 200 to 1280 acres in the Bering river district, about 30 miles from the Copper River & Northwestern railroad. The Matanuska fields are 200 miles from Seward. The government railroad is now under way to that point. Coal from Matanuska can be brought to tidewater at Anchorage, 70 miles south. There are 19 leasing units in Matanuska and 60 in Bering river districts. Both regions contain good bituminous and anthracite coal. Leases will be granted for a period of 50 years. The government takes a royalty and 2 cts. a ton the first 5 years and 5 cts. for the succeeding 20 years. After these 25 years it is provided that the royalty shall not exceed 5% of the selling price of the coal. The royalty is considered small, and was made low for the purpose of encouraging the leasing and development of local markets. Preference, it is said, will be given those insuring the greatest amount of early development. The form of lease is similar to the private leasing in West Virginia.

Douglas.

Diamond drill work is going to be active during the coming summer in this section. The principal work will be carried on at the Jersey City group, the Holman claims and the Tyee mines, surrounding this city. Former Superintendent Kinzie of the Treadwell mines is consulting engineer for the company doing the work.

Richardson.

According to E. E. James, commissioner here, a strike has been made by L. J. Johnson, Walter Johnson and Frank Solly on Michigan creek, a tributary of the Good Paster. How much the ground will go to the foot is not exactly known, but it was stated that the prospectors panned $10 out of one hole. The ground is from 10 to 20 ft. deep, and an average of it will not go over 12 ft. This would be an excellent open-cut proposition, even if the ground was not rich. Several good nuggets have been found, the largest one worth about 72 cts.

Juneau.

Surprisingly good results have been obtained in diamond drilling on the Alaska Gold Belt Co.'s property. They succeeded in finishing 1575 ft. in a horizontal hole. Previously the greatest distance made under similar conditions has been 1500 ft., though greater distances have been attained in vertical holes.

Whitehorse.

Work is under way on [illegible] good season is expected. The Boyle Co. on Hunker creek will place 4 dredges on the field this summer. Each dredge has the capacity of 100,000 cu. yds. per week. The Canadian dredge operated by the Boyle Co. is now working. The Guggenheims have a dredge in operation and are busily preparing others for work. They are constructing a new dredge on Bear creek. In all the Guggenheims will operate at least 4 dredges this season.

ARIZONA.

Miami.

The stockholders of the Miami Mother Lode Mining Co. held a special meeting the 5th and resolved to increase the capital stock of the company from 300,000 to 5,000,000 shares, par value $1, 2,000,000 shares to be set aside for the purpose of accepting options on surrounding property and 3,000,000 to be put into the treasury. The properties now held under option and to be taken over by the company are the Five Points group, 280 acres; the Wm. Schafer group of 280 acres, and the Mother Lode Extension of 400 acres. Active development of the property will be started immediately on 90 and 140 levels of the Five Points. Managing Director Wm. Schafer and Chief Engineer L. M. Greenstein are busily engaged in preparing maps and complete reports preparatory to the listing of the stock on the New York curb. The company owns 1140 acres of mineralized granite and granite porphyry adjacent to the big producers of the Miami district, located in a heretofore neglected section. The mineralized area shows fissure veins traceable on the surface by iron and quartz outcrops. The portion of the property now under development carries three ledges, all prospected to a depth of 140 ft. A crosscut on the 90 discloses 10 ins. of chalcocite and 16 ft. of milling ore.

Globe.

Iron Cap Copper Co., which has been an ore producer since 1912, is shipping an average of 1200 tons per month to El Paso smelter, which samples an average of 10% copper and 7 ozs. silver. This consists of oxides and carbonates, mostly, and is taken from the 800 and 900 levels. On the 900 they are getting into the primary ores, considerable chalcocite coming in there. The main shaft, known as the Williams, is to be equipped with a new double-drum Wellman-Seaver-Morgan hoist, which has been ordered. The company's Iron Cap 2-compartment shaft, 2500 ft. from the Williams, is being enlarged to a 3-compartment. This 600-ft. shaft, which is to be sunk to 1000 ft., is also being equipped with a new double-drum hoist and a Sullivan air compressor, both to be steam operated from Stirling boilers. The two mines are on the Old Dominion ore belt, and their workings are to be connected. The workings of the Williams shaft connect with those of the Arizona Commercial on the northeast. The Iron Cap group, being situated on the divide between Gila and the Salt river drainage, is drained by the deeper workings on Old Dominion and Arizona Commercial, and have no water to handle. The Iron Cap employs 100 men, and is under the management of F. A. Woodward.

The Superior & Boston Copper Co., whose operations are now in charge of A. L. Graham, has five shafts and one tunnel on its property. The 3-compartment, 1200-ft. McGaw shaft is to be sunk 200 ft. deeper with existing equipment, but a heavier hoist and new pumps are being considered. Until recently the lower workings were filled with water, which came to within 60 ft. of the 800 level. In the process [illegible] The plant has two batteries of Stirling boilers, equal to 1000-hp., and if new pumping and hoisting equipment should be put in these boilers probably will serve for power. The plans are to sink for sulphide ores. The production of 1500 tons of ore per month for the last year or more has been by lessees. The mine will be worked on company account from now on.

The Arizona Commercial Mining Co. is installing power equipment in its old smelter building. This consists of two General Electric, Curtis type of horizontal turbo-generators,

600-kws. each; these are to be steam-driven from the old Babcock & Wilcox boilers originally installed for the smelting plant. The electric power to be generated will be used for operating hoists and pumps. A 1500-cu. ft. Nordberg air compressor, to be steam-driven, is to be put in. The company's two mines, the Eureka and Copper Hill, are 1¼ miles apart, on the same ore belt. The Copper Hill electric hoist is being operated from the Old Dominion power line, but the company will soon have its own electric power connected. Other new equipment being put in consists of two Scranton quintuplex plunger pumps, 500 gals. capacity each, on the 1400 level of Copper Hill shaft. This will supplement the work of an Aldrich pump on same level, which handles 550 gals. per minute. Ore shipments, amounting to 5000 tons per month, from the Copper Hill mine to the Old Dominion smelter, consist of sulphides taken from the 1200, 1300 and 1400 levels. Work in Eureka mine consists of exploration and development, with some ore production incidental thereto. The shaft is 1200 ft. deep, but most of the work is on and above the 800 level. The Commercial operations are under the superintendency of R. R. Boyd.

Superior.

John A. Sandal, having 24 claims 4 miles south of Superior, has two veins of copper, gold and silver ore, opened by a crosscut tunnel. He ships 3 carloads of ore per month to A. S. & R. Co. smelter. Selected ore ran 18% copper. He will put in a gas engine and a 3-drill air compressor and drive a deeper tunnel.

Ray.

The 3-compartment shaft being sunk by the Arizona-Hercules Copper Co. is to have a depth of 1000 ft. and in which 10-ton skips will be operated. Two gas engines, 60 and 25-hp., are used at shaft for hoisting and air compression. Four Star drills are kept in operation in prospecting work, there being now 46 drill holes on the company's property, of varying depth. Shipments of carbonate ore from surface workings, and down to 100 ft., are being made, of grades ranging from 5 to 12½ and 13% copper. Sulphide ores, consisting of chalcocite and chalcopyrite, are opened by drill holes at various depths. The concentration mill, to be built near Kelvin, for which plans are being made by Bradley, Bruff & Le Barthe, will be operated by electric power, to be generated by Deisel engines in the company's own power plant. C. E. Addams, general manager for the company, came recently from the Beers Con. mines, Kimberly, South Africa, where he was manager; he was also connected with Voorspoed diamond mines, in the same country.

Pinal Development Co., which took over the old Renfro group of mining claims, has purchased a gasoline hoist and air compressor, and has begun sinking a shaft which is to be 300 ft. deep. The location is on the copper belt that runs through Superior, Ray, Troy and Christmas, and is in the vicinity of the London-Arizona group, 4 miles from the railroad. It is developed by a 1175-ft. tunnel, designed to cut the ore zone at 500 ft. depth. The shaft location is near the base of the mountain slope, below the tunnel entrance. Surface ores are of good grade and oxidized, and by sinking it is believed the primary ore zone will be reached at 100 ft. On this slope the secondary ore deposit has been exposed by erosion. It is thought these ores will not require concentrating, but the tentative plan contemplates the construction of an aerial tramway from mine to railroad. J. C. Devine, Ray, who for a number of years was assistant superintendent of mines for the Ray Con. Copper Co., lately resigned his position to become president and manager of the Pinal Development. Among other stockholders are T. M. Blake of Gila Bank & Trust Co.; John H. Robinson, Prescott; Dr. F. C. Norman, Jerome; R. H. Boxall and Chas. Hollister, Ray. Aggressive work is intended.

Hayden.

The Hayden smelting plant of A. S. & R. Co. will be increased in capacity 50% by the operation of new equipment being installed, giving the works a capacity of 1300 tons per day. The two reverberatory furnaces now in use have a capacity of 400 tons each, and the new reverberatory being built will be of 500 tons capacity. There are now eight McDougal roasters in operation, and four more are being installed. Other improvements consist of new sampling works in a steel building, having capacity to crush 75 tons per hour to ½-in. size. It is being equipped with all modern facilities. The plant has three converters, a Morgan 60-ton crane, and a machine for casting blister copper, this being operated on a Walker wheel by electric power. The plant is operating at full capacity, handling 500 to 600 tons of concentrates per day from the Ray Con. mill. In addition to this shipments of silicious custom ore are received from other parts of the state, including Yavapai and Yuma counties. A new Allis-Chalmers compound, reciprocating blowing engine, lately put in operation, delivers 26,000 cu. ft. of air per minute, under 14-lb. pressure. At these works R. B. Green is superintendent and H. T. Murray, assistant, with S. H. Levison as chief chemist and assayer.

Ray Con. Copper Co. is building at Hayden a new filter plant for filtering the flotation concentrates. The equipment includes Dorr thickeners, and Portland filters, built by Colorado Iron Works.

Christmas.

The Christmas mine, under the superintendency of S. H. Sherman, is mining 7500 tons of self-fluxing low-grade copper ore per month, usually handled at Hayden smelter, but which lately has been sent to Sasco smelter. The ore is transported from the mine to the railroad on the Gila over an aerial tramway a mile in length. This mine belongs to the A. S. & R. Co.

CALIFORNIA.

Bishop.

The tunnel on the Aeroplane claim of the Standard group has cut the ledge of tungsten-bearing ore at an approximate depth of 70 ft. An upper tunnel shows over 20 ft. of ore and a shaft is being sunk from the outcrop to reach the ledge. Frame work and ore bins of the 75-ton mill are in place and installation of machinery is about to begin. A tram is to be built from mine to mill. L. E. Porter is superintendent.

The Tungsten Mines Co. has begun construction of the building for its 200-ton mill; 20 men are at work. An upper tunnel has tapped the ore body on the Little Sister claim at a depth of 75 ft., and the lower tunnel is expected to reach the ore within 200 ft. from the present face. It is now in 130 ft. The company is erecting cottages for the men and several buildings for company use; 100 men are on the payroll. L. L. Stevens is general manager and Cooper Shapley, superintendent.

Atolia.

It is reported the Atolia Mining Co. is preparing to return to the leasing system. Late operations have not been satisfactory; high-grading has seriously cut down profits. While this company has greatly curtailed production, several other concerns are active, and the output of the district has increased to more than 100 tons per day. The population of Atolia is now fully 1200, and the tungsten-bearing area has been extended 10 to 12 miles to the east and west and 5 miles north and south.

Randsburg.

The Yellow Aster Mining Co. is planning improvements to its mill designed to effect a closer gold saving. The 100-stamp mill is crushing 500 tons per day yielding approximately $40,000 per month by amalgamation. The mine is reported in excellent condition, with ore reserves sufficient to insure a long run of the mill. It is likely additional mine machinery will be installed this year.

Heroult.

A shortage of manganese ore has forced the management of the Heroult electric smelter to commence production of pig iron, but it is expected to resume the making of ferro-manganese in a short time. A promising deposit is being opened near Clipper Mills and shipments from this point will soon begin.

Kennett.

The Mammoth Copper Co. has completed purchase of the Stowell mine for $65,000 and payment of delinquent taxes amounting to $13,000. The company has been develop-

ing the Stowell under bond and [illegible] has demonstrated the existence of large reserves of profitable ore. An excellent camp has been erected at the mine preliminary to more comprehensive work. Extensive developments are proceeding at the Friday-Lowden, Spread Eagle and main Mammoth holdings; 1200 men are on the payroll.

The Mammoth, Balaklala and Mountain Copper companies have granted their employes another wage advance of 25 cts. a day. Approximately 2000 men are affected. The Mammoth is also paying an additional bonus for work above a specified standard in the driving of the two large tunnels being extended to open the main deposits to further depth.

Nevada City.

The vein recently intersected in the Providence mine of the Champion group is reported to be developing well. The quartz carries tellurides and shipments are being made direct to smelters. Much of this ore is said to be of bonanza character. The strike was made in the long east drift from the 1800 level, in a virgin section of the property, and drifting is proceeding to determine the extent of the ore body. The property is owned and operated by the North Star Mines Co., operating the North Star group at Grass Valley.

Sutter Creek.

The South Eureka Co. has placed 10 stamps of the Oneida mill in action on ore from the lower levels of the Oneida mine. It is planned to increase the mill capacity to take care of ore developed east of the main South Eureka workings. The 80-stamp South Eureka mill is running steadily on ore from the South Eureka. Connections between the South Eureka shaft and Oneida mine have been established and good ore opened in old workings of the Oneida, thought by the old operators to have been worked out.

The Sutter Creek Mining Co. is rapidly unwatering the Poundstone mine and expects to start work in the upper levels at an early date. Reopening of the old shaft, north of the main workings, is proceeding with a small crew. The property is equipped with a 10-stamp mill and good mine plant.

Jackson.

The Argonaut Mining Co. has placed orders with a local foundry for the building of a 40-stamp mill, which will displace the plant now in use. It will be erected west of the present mill, where facilities for storing the tailings are good. A natural basin exists at this point and a restraining dam, 400 ft. long and 40 ft. high, is being built to prevent escape of the tailings.

Sierra City.

The Young America quartz mine has been sold to A. C. Aiken for delinquent taxes, and plans are being formed for resumption of work. The old dumps at tunnels 2, 3 and 4 will be first sent through the mill, and underground work then prosecuted.

Poker Flat.

Preparations are being completed for extensive sluicing at the Bunker Hill-Herkiner placer mine, 4 miles east of here. A large body of pay gravel was intersected last January, but deep snow prevented production. The Bunker Hill was worked over 40 years ago and is credited with a yield of $3,000,000.

Redding.

The El Oro Dredging Co. has sunk 25 holes on the Arnold ranch with Keystone drill and has found good gravel at several points. The company is planning the building of a dredge near this point if the gravel prospects favorably, and has recently taken under option the Diestelhorst ranch of 150 acres, just across the Sacramento river from Redding. Most of the gravel recently prospected averages about 17 ft. in depth.

COLORADO.

Boulder.

Operators in the district [illegible] cause of lower tungsten prices. With this in view, all producers are stocking their product to keep it off the market. In exceptions which are unavoidable ore will be sold at $25 per unit to those who will keep it out of the open market. The producers are holding for $50 per unit.

Among the exceptions to the above, W. W. Dedge is buying ore at $25 with which to supply his mill. He expects to have it in operation about the first week in July. The mill is at Bummer gulch and the 400-ton bins have been completed. These will be filled as soon as the road now being graded and cut is completed. The mill will have 75 tons capacity and is being built by the Colorado Iron Works, Denver, under the personal supervision of W. A. Kunkel.

Low-grade, left during the bonanza days of the Livingston mine, is now being mined by the United States Gold Corporation. The mill was started the first of 1916. The ores average from $10 to $30, and in the east part of the 400 level the vein has been found beyond the fault and will be in the formerly rich No. 1 ore body by July 1. A strike was made of ore carrying from 200 to 400 ozs. gold, worth $4000 to $8000 per ton. In the breast of the 400 level west of the Nyanza vein, the Potato patch ore shoot was encountered and in it was silvanite ore. It carries the same gold values that the body had in the surface workings 400 ft. above. The rich ore shoot had never been found below the 120-ft. level until the workings of the 400 level were reached. The streak of high grade is 3 to 4 ins. wide and with it is a vein of excellent milling ore. The Nyanza ore body, 10 ft. wide, is turning out a tremendous amount of ore for the mill and thus the lowest level of the mine becomes the center of activity, though the reserves of the older levels are drawn on to supplement the demands of the mill, which is gradually being brought up to 75 tons capacity.

Rico.

According to J. C. Jensen, manager of the Rico Argentine mines, the new tunnel has run on the fissure a distance of 28 ft. and 2 ft. of this shows some lead, silver and 23% zinc. Two feet on each side of this drift is well mineralized and the formation is improving. The tunnel is being sent under the old workings, which showed an immense tonnage of copper ore. They cut a station and are making a raise to connect with the first of the old workings. This will give better ventilation and a line on the ore occurrences. This raise is up 25 ft. and has 15 ft. more to reach the contact. The tunnel is being sent ahead while the raise is made and is now some distance beyond the station. When the contact is reached the management will drift on it to the southeast and in this work some good development is looked for. The last 52 ft. in the tunnel drift is much improved and the last 10 ft. indicates that the first large copper deposit may come in earlier than indicated by the survey. The engineer's report shows that the copper deposit is 100 ft. ahead of the present face of the tunnel.

Georgetown.

Lessees are active at the Capital mines. Hamilton & Culberson received $2500 for 30 tons of ore, besides which the concentrates and bullion from their mill dirt netted $900. They now have 25 tons of ore ready to ship. DeMasters had 125 tons run through the mill. Holcombe & Co. run 100 tons of mill dirt. Their ore is widening out in each three raises. Pearson & Johnson have 125 tons going through the mill. Prousse & Co. have made a shipment of 20 tons of smelting ore. Hanson & Walthers are still drifting on 2 ft. of ore, which is becoming more solid. Dick Kane, leasing on the Kane adit, has 3 mill holes started. The ore is improving and he will soon be ready to start his stope. After this is accomplished more leases will be let in the adit, as ore is showing all along the course. The shaft to be sunk a distance of 250 ft. from the Kane adit to connect with the raise from the Capital tunnel may be commenced in the near future. The sooner this can be done the greater will be the output of the mine and less the cost of operation, as the circulation of air which will be created all through the mine will allow the working of more men.

Cripple Creek.

Two good showings have been made by lessees at the Prince Albert on the south slope of Beacon hill. Henry von Phul, who has the lease on blocks 10 and 12, has been prospecting at surface west of the open cut. In a shallow pros-

feet shaft not to exceed 10 or 12 ft. deep he has exposed a vein lying parallel to the Gold Dollar extension under development from the open cut. The vein is a strong one. Assays from liberal samples have returned values of 6 and 7 ozs. gold and surface indications are for a permanent vein containing sylvanite. Pavitte & Co., working from a winze sunk from the Hland tunnel level, at a depth of 40 ft. below the floor of the tunnel, in a lateral carried north on what is believed the southern extension of the Little May vein of the El Paso system, is sacking a fluorite quartz and sand, in which both calaverite and rusty gold are present, the calaverite predominating. Samples gave results as sand streak, 2 ins. wide, 226.52 ozs. gold, or $4530.40; fluorite quartz, 6-in. streak, 8.56 ozs. gold, or $171.20; grab samples from ore sack, 12.36 ozs. gold, or $247.20 to the ton. The ore body as exposed lies on the main contact, between the granite and the phonolite plug of Beacon Hill, at 125 ft. in from the portal and at an approximate depth from surface above the tunnel of 100 ft.

GEORGIA.

Dahlonega.

That considerable gold is often locked up and unobtainable from a raw sulphide ore has been proved by the Standard mine, in charge of Mr. Tonson. He states that by roasting his ores in the recent past he has been able to obtain a very large percentage, greater than when the gold was recovered from the raw sulphide.

The Findley Ridge Co. has put an air line from the compressor at the machine shop to the Wallace vein, a distance of 1500 ft. At the mine it is putting in a hoist, pump and air drills, and will be ready to produce within a few days. The shaft and tunnel will be lighted by electricity. The ore will be milled at the Crown Mountain mill, and tailings, after passing over the plates, will be concentrated on a Diester table. The company also intends to open the lower Wallace and the sulphide veins in the Preacher cut as soon as possible.

IDAHO.

Kellogg.

The first car of concentrates from the Black Hawk mine, on Grouse gulch, was shipped to the smelter last Thursday, according to William Beaudry, general manager of the Stewart Mining Co., who recently acquired the property under lease. "With the concentrates I shall ship a small quantity of crude ore that will run between 35 and 40% lead," said Beaudry. "I began extracting ore from the Black Hawk on May 28, and have been milling the output at the Ontario plant on Government gulch, the average treated being about 50 tons daily. To date we have turned out about 500 tons. The ore is mostly from development and averages about 8% lead and 2 to 3% zinc. From the ore bodies which had been partially developed by the Federal I am taking out ore that contains about 6% each of lead and zinc. Some other parties have a lease from the Federal on the adjoining Wyoming mine, but they have not yet produced any ore."

A special meeting of the stockholders of the Stewart Mining Co. has been called to be held July 8, to vote on increasing the capital from $1,250,000 to $3,000,000. Books closed June 5 and reopen July 11. In a circular to the stockholders the directors say that during the past winter the operations at the mines were prosecuted continuously, although the production of ore was reduced because of a limitation in the extent and value of the ore at the present workings. The circular says: "The development work in the grounds of the Coeur d'Alene Development Co., controlled by the Stewart Mining Co., has uncovered considerable commercial ore which is now being mined at the rate of approximately 50 tons per day. While development work is constantly in progress on both of these properties along promising lines, it is still the judgment of the directors that additional property should be acquired in order that the future of the company as a dividend-paying property may be assured. During the last year our engineers have examined many mining properties. The only purchase of new property so far made has been the controlling interest of the Coeur d'Alene Development Co., paid for with treasury stock, as reported to the stockholders in a previous letter. None of the properties examined has been reported upon favorably by our engineers, except two on which this company now holds options and which are being made the subject of further examination. It is confidently expected that one of these properties will be approved, in which event the same should be immediately purchased and operated so as to take advantage of the present high price of metals. Your directors will be able to purchase such additional property or properties with treasury stock, but in order to do this the capital stock of the company must be increased, as there is now only a small amount of treasury stock on hand." The circular says that the plan already has the sanction of the largest individual stockholders.

Wallace.

Another examination of Nabob, Sidney and Little Pittsburg is being made by men apparently representing the Anaconda Copper Co., which already has acquired the Douglas. W. Y. Clark is again at the properties, and it is said that this time there is with him W. J. Kelly, superintendent of the Douglas. James Breen examined the claims a few days ago and then went to Butte. It is said the examination being made by Kelly is of the Little Pittsburg in particular and is the final inspection for the Anaconda. When the Douglas was taken over by the Anaconda it was generally understood that if it proved to be as good as expected it would be followed by other purchases by this company, which is supposed to be better able to handle the zinc ores of Pine creek than any other company because of the electrolytic plant which it is operating at Anaconda. Reports from Kellogg are that the ore strike recently made in the Nabob is widening out with every foot of additional distance penetrated and the owners are much pleased with the outlook. The Little Pittsburg lies in an easterly direction and adjoining the Nabob. The Sidney adjoins them on the north and is said to have a vein indicating one of the best bodies of zinc ores on the creek. It is claimed that the Federal Mining Co. has attempted to buy this property, and that Jerome J. Day in the past made two or three trips of inspection to it, contemplating a purchase. This group of claims is 2 miles from the Douglas, already owned by the Anaconda people, but is down the creek on a branch gulch.

"The Nellie Mining & Milling Co. has bonded for $42,500 the Coeur d'Alene Nellie and Emma-Nevada claims, and paid $2125 down May 15," said Frank Cushing, one of the incorporators. "Nothing more is to be paid during the next 18 months. The property is located 1½ miles south of Osborne." "The mine has been unwatered," said F. B. Costello, one of the directors, "and at the bottom of the shaft a ledge 4 ft. wide has been uncovered. It carries 40 ozs. silver and 3% copper. Arrangements have been made to handle the ore at the mill being built adjoining the property by the Silverado Mining Co. This mill will be in operation in 90 days or less." C. E. Benedict is president of the new corporation, Ollie E. Cushing, vice-president, and Frank Cushing, secretary-treasurer. These, with K. B. Skibeness, F. B. Costello, B. P. Smith and B. A. Barnes, constitute the board of directors. There are 600,000 shares of stock in the company, of the par value of 10 cts. The Coeur d'Alene Nellie and the Emma-Nevada claims have been secured from J. A. Alger, A. P. Harton and O. R. Young.

The contract with the American Smelting & Refining Co. having expired, the Tamarack & Custer Con. Mining Co., which owns and operates the Tamarck & Chesapeake and Custer groups of lead-silver claims has closed down its properties temporarily, pending diversion of the output to the Northport smelter, recently constructed and put in commission by the Tamarack & Custer and Hercules Mining companies. The Northport smelter, blown in March 7, has but two furnaces in service, and the capacity of these is being taxed to handle the output of the Hercules. A third furnace now is being installed and probably will be operating about June 20, when shipments will be inaugurated from the Tamarack & Custer properties. The company has plans pre-

pared for construction of a [illegible] the capacity output of the mines, and it is believed the plant will be built near the Hercules mill.

The Spokane syndicate, recently organized by William A. Nicholls and associates, that acquired control of the Alameda Mining Co., with properties adjoining the Success holdings, has begun active development, under the supervision of R. R. Catching, who resigned as superintendent of the National Copper Co. at Mullan several months ago. The long crosscut being driven to tap the ore bodies at depth has been advanced 60 ft. by hand work, two shifts being employed, but power equipment soon is to be installed. An electric motor already is on the ground, and the compressor has been ordered and will be delivered soon. Necessary camp and other buildings have been erected.

The directors of the Success Mining Co. have declared the regular monthly dividend of 3 cts. a share, or $45,000, payable the 25th, to stockholders of record the 15th. This will make the disbursements for the first half of the current year $300,000, and will increase the grand total to $1,895,000, including $900,000 credited to the old Granite Mining Co., which owned and operated the Success mine prior to its acquisition by the Success. No official report has been made of the earnings of the Success in May, the first month since the new contract with the Grasselli Chemical Co. of Cleveland, O., became effective, but it is said that President P. J. Gearon has informed some of his stockholders that the net profits for the period will be approximately $90,000, or twice dividend requirements at the prevailing rate.

LAKE SUPERIOR.

COPPER.

Houghton.

Adventure is waiting for the timber for shaft No. 3. As the shaft has been standing idle for quite a long time, it is not safe to unwater before timbering the collar, which is about 80 ft. long; the water is within 30 to 40 ft. of the surface. The timber is on its way from the Pacific coast. It will be at least 2 months before there can be any production, as after the water is out and the shaft timbered, it will be necessary to test the Butler, Knowlton, and perhaps the Evergreen lodes in order to ascertain the most likely places. The Butler lode itself, if there is anything in its mineral contents similar to its showings at the Mass, South Lake and at the Michigan, will make a paying mine. Supt. Walker can be depended upon to make the most of his opportunities, as at the Mass and Lake his work has been, of course, on the lodes of the Knowlton and Evergreen series, which cross this property, and especially as his success at the former property has been made on the Butler lode. There are now 25 men employed in getting the surface plant ready, and the force will be increased gradually.

Wyandot will be shipping its rock to the Winona mill in a short time, instead of to the Copper Range's mill, as intended before the destruction of the Trimountain mill by fire. There are now four stopes on the 9th and 10th levels. The contract of hauling the rock to the railroad has just been given to Smith & Sparks.

Mass had a better daily average tonnage for May than April, and there will be somewhat of an increase this month. The development work has been decreased to some degree recently, owing to the scarcity of men.

White Pine Extension has crosscut from its shaft, which is very close to its copper-bearing sandstone and intervening shale beds, and has drifted a short distance on each side, with a showing of about 100 lbs. to the ton, as against 13 as indicated by the diamond drill. This work is about a mile from the exploration shaft, where the beds were first opened and at intervals trenching has been done, displaying good values the entire distance.

Porcupine Exploration Co., which has been exploring with three drills west on the curve of the formations next to the White Pine Extension, has not met with any encouraging disclosures, and has discontinued and given over its options. This company was headed by Nathan Leopold of Chicago. It is very likely that an engineer familiar with this part of the copper-bearing series will soon begin exploration here.

Algonac, which is the name the development interests comprising T. F. Cole, S. L. Smith and the Stanton brothers, have given to the four sections lying between the Nonesuch and the White Pine Extension, is now managed wholly by General Manager Dengler of the Mohawk, Wolverine and White Pine Extension companies, Consulting Engineer F. B. Close having resigned to take up other development work for S. L. Smith.

White Pine is milling about 8000 tons daily, and one who has visited the mill lately says that the amount of mineral on the Willley tables is much greater than ever before, there being a width of about 3 ft. wide rich with copper. The recent discovery of high-grades by the diamond drill at a depth of 2100 ft. gives assurance for the life of this property, both because there was some doubt whether the beds extended beyond a fault encountered at the depth of 1150 ft., with trap below, and because with the slight dip of this strata averaging only about 20° this depth itself gives a long reach on the formations.

Isle Royale has recently reached the 11th level at No. 6 shaft and has for the time discontinued sinking there. The ground is good and somewhat better than on the levels above. No. 5 is sinking below the 15th and No. 2 below the 30th level. This mine is maintaining the great output of 2900 tons daily, which is remarkable, both on account of the great development work that is being done simultaneously with the stoping, and the scarcity of labor. No. 4 is the banner shaft and all the way down from the 6th level the ground averages high. It is estimated that the mine is earning $150,000 monthly at the present, or something over 13 lbs., which will be increased as soon as the reserves reach the proper amount and the development work is reduced to just enough to balance the quantity of rock taken out.

Houghton Copper is finding better ground on the 12th level north and is going to crosscut to the lode on the 4th level, where the ground has never been opened. The north drift on the 6th level is getting a good grade of rock about 400 ft. from the shaft. The crosscut on the 12th level in search for the West vein of the Superior mine is in about 100 ft. and no lode has yet been met with. This is not surprising, however, as in many places at the Superior the distance is much greater. There will now be operated four drills.

Calumet & Hecla's third new furnace, the other two having been running nearly 2 years, went into commission last week. This has a capacity of over 150,000 lbs. of refined copper every other day and is equipped with the Walker casting machine. There are 18 other smaller furnaces.

Carp Lake's outcrop has just been thoroughly gone over by Jerry Rourke, the mining engineer in charge of the exploration work, and he finds that his first impressions have been verified and that the lower portion of the vein is richer and much more extensive than the upper. He states the lower portion of the vein, separated by 15 ft. from the upper portion, which has a width of 6, is so remarkable that it is difficult to understand how a mine with such a showing could have lain dormant for 50 years, if it had not been for the impossibility of recovering the fine copper at that time. About one-half mile east of the old workings at No. 9 shaft he found this strip to run above the usual average for commercial copper for this district, with richer copper a short distance west of this point, and also 200 ft. to the east, where a cut was made down the side of the cliff opening up copper which runs 200 lbs. H. L. Paine, who was several months on the ground, reported that the most careful sampling possible without resorting to a mill test demonstrates the upper 6 ft. of vein to carry 53 lbs. H. H. Catlin estimates it to carry 44 lbs., and that the vein on every part exposed for the length of a mile and below the zone of oxidation, has copper in merchantable quantities. In the lowest workings 350 ft. below the outcrop there is much rock that could be hand-sorted which would run as high as some of the rock now sent to the smelters from the mills. This property, 22 miles west of Ontonagon, has 1610 acres, and has 2 miles on the strike of the vein. Leaving Lake Superior to the south

the ground rises gradually for half a mile and then takes a steeper pitch to the highest point of the Porcupine mountains, 1000 ft. above the level of the sea, about a mile from the shore. The south slope is very precipitous, consisting of vertical cliffs several hundred feet high exposing the formations clearly to view. The copper-bearing strata are below 100 ft. of trap and run east and west, dipping north under the lake. A company is now being organized by R. T. Looney, who controls the property.

IRON.

Duluth.

There has been a cut in the price of some grades of ore in this district and it is said this has caused a curtailment in the production of some of the mines. The ores which were cut in price were certain grades of non-bessemer ore. Even for this shipments for May, 1916, were 2,026,338 tons larger than May, 1915, at the upper lake ports. The movement was the heaviest in the history of the trade, breaking the previous record that was made in July, 1913. During May 8,449,580 tons of iron ore went to lower lake ports. This was an increase of 3,437,221 tons over the shipments for May of last year. The movement to June 1, this year, reached the total of 10,107,991 tons, an increase of about 4,500,000 tons over the same period of 1915. Following are the shipments by ports for May: Escanaba, 1,045,186; Marquette, 561,555; Ashland, 955,041; Superior, 1,722,341; Duluth, 2,671,044; Two Harbors, 1,499,413.

Iron Mountain.

The Breitung interests have purchased 75% of the stock in the North Traders property from John T. Spencer. The Clifford Extension Mining Co. will be organized to develop the property. Spencer has been exploring this property during the past several months, and a considerable body of ore has been proven up. The exploratory is located to the west and north of the present open pit on the Antoine Ore Co.'s land. The Breitung interests will sink a shaft 124 ft. and will also do some stripping. The overburden of earth at this point is not deep and a large body of low-grade phosphorous ore can be uncovered at small cost. The company contemplates making a shipment of about 50,000 tons before the close of the season.

The stripping of the Indiana iron mine has been about completed. The property will be worked as an open pit. The ore broken will be milled to the main level and sent to surface in skips, the main tunnel being under the deposit. The ore is a silicious one.

Negaunee.

In the continuation of sinking in the main shaft at the Athens mine a pocket of ore has been cut at 1500 ft. A drift is in the ore 40 ft. and the ore is being stocked on surface. Diamond drills gave no sign of this deposit, as it is probably of small dimensions. The finding of the ore will give a little return in dollars for the big expenditure being made here. The shaft is now down 1600 ft., and the first level will be started at 1850 ft. The shaft is to be kept going steadily to 2600 ft., which will make it the deepest, vertically, on the iron ranges of Lake Superior. The shaft is circular to a depth of 1000 ft., and is concreted solid from top to this depth. Below 1000 ft. it is rectangular, this form having been adopted to secure greater progress in sinking. At every 100 ft. below the 1000 level bearers are being put in concrete, upon which, later, concrete work will rest. This will aid in concreting the shaft to the bottom. The shaft is sinking at the rate of about 125 ft. per month.

MISSOURI-KANSAS.

Joplin.

The purchase of the Granby Mining & Smelting Co. by the American Zinc, Lead & Smelting Co. at a price said to have been about $7,500,000, has been announced. No plans for the handling of the property acquired have so far been given out.

Chapman Brothers & Longacre are progressing with the construction of their new 500-ton concentrator. It is on a tract of the Chapman land adjoining the Mont B. mine on the northeast. The structure of the building has been completed. The tram to the mill from the shaft is nearly ready and work of opening up the ground is under way in order that it may be ready by the time the mill is. The completed plant will cost not less than $90,000, it is said, though the first estimate was $10,000 under that amount.

A merger has been brought about between the Picher Lead Co. and the Eagle Lead Co. The new concern's name is the Eagle-Picher Lead Co. A number of changes are contemplated. O. S. Picher, former president and general manager of the Picher company, remains the president of the new merger.

Duenweg.

Fitzer & Kellar, contractors, have completed the new concentrator for the Evans-Hall-Soy Mining Co. It has 300-ton capacity per 10 hours. It is steam-driven by a 150-hp. Corliss engine. The compressor is of 1200-cu. ft. capacity. There is a 6-cell rougher jig and a 7-cell cleaner, one 36-in. set of rolls, two of 30 ins. and one of 24. Dirt will be taken from two shafts. The tramway connecting the mill with the shaft has been completed. There is a 400-ton hopper at the mill and one of 200 tons at the shaft. The sludge department is not separate from the remainder of the mill. It occupys the same building and is run from the same line shaft. It consists of 6 sludge tables, set in pairs, and there is a settling tank in connection. The entire mill has taken about 60 days to construct. It is on the C. T. Orr land, southwest of the Athletic mine. Considerable of the ground has been well opened and operations will start on the 200 level.

The Meadow Lark 80 has been bought by the Kansas-Missouri Land & Mining Co. from L. H. Beckman, Cincinnati. Recent drilling of the O. M. Prospecting Co. has shown a great body of ore at a depth of 120 ft. It lays a quarter of a mile south of the Central States' silicate mine. Shallow drilling on the land revealed both calamine and lead at depths of from 10 to 40 ft.

Sarcoxie.

The United States Smelting Co. has abandoned the Reeds mine near here. They will move the mill to a recently acquired lease adjoining the rich Blue Goose property at Cardin, Okla. The lease is one for which the company reputedly paid $125,000. The first lease belongs to Talmage. It was subleased to B. H. Marbury some months ago on an option for sale at $75,000. Marbury sunk 20 holes and 18 of them showed rich ore, similar to that found at the Blue Goose mine near by. Two new shafts have been started by the United States Co. and it is understood they plan pushing construction of their mill. The company spent considerable at the Reeds property. In January they turned in 465,510 lbs. of blende. It was estimated by outside authorities that they spent about $1,000,000 at the mine, getting it in shape. Extensive drill prospecting was done preliminary to starting reconstructive work on the mill and it was understood there was work ahead for many months.

MONTANA.

Butte.

The Washoe smelter broke its record in the production of copper last month, with a total output of 26,900,000 lbs. This was the greatest run the big plant has ever made. The Great Falls reduction works showed a big falling off from the production of April. The production for May was in the neighborhood of only 4,000,000 lbs. of copper as against nearly double that amount in April. The total production of the two smelters for May was about 31,000,000 lbs. of copper, as against a production in April of 33,600,000 lbs.

The returns for May at the Butte & Superior show the total tonnage of ore mined at the Black Rock was in excess of 54,000 tons. From this 15,200 tons of concentrates were secured and the total amount of zinc in concentrates was estimated at 16,000,000 lbs. This is close to the production for the month of April. The recoveries were approximately 93%. Rapid work has been done on the two new shafts and at present rate of sinking, one of the new shafts will be

completed to the 1500 level be [illegible] as this shaft is down the situation at the Black Rock will be greatly improved as the Butte & Superior Co. has to rely on the one shaft at the Black Rock for hoisting and carrying on mining operations. The silver production for the month is estimated at 300,000 ozs., or slightly lower than the April production. The lead production was close to 250,000 lbs. These estimates are under those given out some 10 days ago from unofficial sources. The estimated cost of zinc production is 4 cts. per pound, after crediting the values of other metals. Most of the output of the Butte & Superior for April, May and June was sold before the present quarter began and at prices that are better than the present market price of spelter. That the company's profits for the current quarter will be fully up to those made in the first quarter of this year is the prediction of insiders. The earnings for the first 3 months of this year were $3,554,910, or at the rate of about $52 per share per annum. The tonnage for that quarter was 164,500 tons. The tonnage for April and May is practically at the same rate and will bring the tonnage for the second quarter very close to those figures. Development work on the 900 level west of the shaft on the Jersey Blue insures a continuance of the ore body in that vein. An ore body of considerable size has been developed on the 1100 level west of the shaft and on the same level east of the shaft, an ore body 12 ft. wide has been developed for a distance of 200 ft.

The Tuolumne Mining Co., which recently closed a contract with the Colusa-Leonard Extension Co. whereby Tuolumne is to thoroughly develop the Colusa-Leonard ground, will start work soon with shaft-sinking operations. W. E. Reynolds, secretary of the Colusa-Leonard Extension Co., will leave in a few days for Phoenix, Ariz., to attend a stockholders' meeting, when the contract between the Colusa-Leonard and the Tuolumne companies will be ratified. It is planned by the Tuolumne Co.—the plans are clearly set forth in the contract—to continue sinking the shaft of the Colusa-Leonard, which is now down 628 ft., to the 1628-ft. mark and to crosscut to the north and south lines, a distance of 1800 ft. The Tropic mine of the Anaconda Co., which is said to be netting that company $1,500,000 a year from ore being mined on its upper levels alone, adjoins the Colusa-Leonard Extension on the south and east. It is said by miners working in the Tropic that the ore body on the 400 level of that property is five sets wide—about 25 ft. On the 500 level of the Tropic it is reported that native copper is being mined. The reopening and development of the Colusa-Leonard Extension property is another tribute to the energy and industry of W. W. McDowell, who, with his immediate associates, has made a remarkable record in bringing big eastern capital to this state for investment purposes.

Helena.

In a report by the state industrial accident board covering 11 months of its existence, it is shown that, estimating the expenses of the board on what they have been in the past, there will be turned back into the state treasury $12,000 of the $50,000 appropriated to administer the compensation law until the next meeting of the legislature. The claims for compensation presented to the board and allowed so far aggregate $360,000, considerably more than $1000 a day. There are now 60,000 employes under the law.

Shipments from the Scratch Gravel mine to the East Helena smelter so far during June indicate a production of 12 to 16 carloads for the month, according to Manager T. B. Miller. Net smelter returns, which have averaged since shipments were begun about a year ago $2300 a car, now are running close to $2000 a car. The company's income for the month is estimated at from [illegible] The total operating expense, including all development work and the sinking of the main shaft from the 300 to the 500 level, is a trifle under $5000 monthly. The mine was recently equipped with a complete steam plant.

Maxville.

An important strike has been made in the Brooklyn mine, near here, according to Supt. Spaulding. The discovery was made in a crosscut from the main lower crosscut at a vertical depth of 280 ft., where it is said there now are 6 ft. of ore, part of shipping grade and all good milling. The vein is being drifted on, and about 30 [illegible] daily in course of development. The Brooklyn is one of the oldest developed properties in the district, and for a time was under option to General Charles S. Warren of Butte. During this period shipments aggregating not less than $100,000 were made to the Washoe smelter at Anaconda, the returns showing values of 2 to 3% copper and 45 to 65 ozs. silver. The holdings were taken over about 6 months ago by Spokane men, and since then equipment has been installed and a 100-ton mill, which will be ready to operate about June 20, has been built. The Brooklyn is a limited corporation, having but 40 stockholders, all of whom live in and near Spokane. Edward Meilke and Henry Krueger, Davenport, Wash., are president and vice-president, respectively; D. K. McDonald is secretary-treasurer and general manager, and the other directors are H. A. Hamaurer and H. A. Bursch, Rocklyn, Wash. The company is capitalized for 1,500,000 shares at 10 cts. each, of which 1,250,000 are issued.

NEVADA.

Goldfield.

The Goldfield Con. Co. is installing equipment for its 1000-ton flotation plant and expects to have it in operation within 3 weeks. The new machinery is being placed in position without serious interruption to normal mill operations. The company is prosecuting extensive work in the lower levels of the Red Top and Laguna mines, preparatory to drawing a heavy tonnage of copper-gold ore from these workings. In the Mohawk, Combination and other mines deeper work has been started. Final returns from April operations show net profits of $60,041.

Officials of the Lone Star Con. Mining Co. announced last week that control of the property had passed into the hands of strong eastern interests and that developments will be immediately started along comprehensive lines. The holdings comprise the largest area owned by any company in the district, excepting Goldfield Con., and some good ore was formerly mined by lessees.

The Diamondfield Black Butte Co. is preparing to make a shipment of good ore from the 135 level of the old Dortsch lease. The company has also arranged to install a compressor and other machinery at its Orizaba mine, north of Millers. Considerable shipping ore and a large tonnage of mill ore has been developed. L. K. Koontz of Goldfield is president.

In the Sandstorm-Kendall drifts are being extended from the 350 level to thoroughly explore the rhyolite-andesite contact. Some rich ore was mined near this point in the early days of the district. The company continues to drift on shoots of fair-grade ore in the deeper workings.

In its usual conservative fashion, the Round Mountain Mining Co. has made known preliminary estimates of its extraction from the placer workings, now being operated with a largely increased water supply. James R. Davis, vice-president of the company, and W. H. Weber of Denver, one of the directors, reported to President L. R. Gordon that there has been handled, between March 9 and May 31, 106,600 yds. of gold-bearing earth, and that the sluices had yielded not less than $40,000. Of the 83 days elapsed, it was possible to operate under a full head of water for two-thirds of the time, or 55 days. There has been no recovery as yet from the bed rock, where a large percentage of the values are recovered, and for this reason no statement as to gross or net earnings is available. During the 1915 season, however, the placer ground yielded $2 yer yard, and in the preceding year, from all sources, including lessees' accounts, the values exceeded $1.50 per yard.

Tonopah.

An electric hoist is being installed over the winze from the 950 level of the Rescue-Eula mine, and sinking to a depth of at least 200 ft. is about to start. The three raises on the vein are all in ore of good milling grade and shipments to the West End mill are averaging 150 tons per week.

The output of the Tonopah district continues to average from 8700 to 9400 tons per week. Belmont is averaging over 3000; Tonopah Mining, 2100; Tonopah Extension, 1850;

Jim Butler, 750; West End, 566. Rescue-Eula, North Star, Halifax, Midway and Montana are producing small tonnages. Tonopah Extension is installing equipment which will increase the mill capacity fully 2500 tons per month, and Halifax and one or two others are also preparing to make heavier yields.

Ely.

The largest shipment of tungsten concentrates ever sent out of White Pine county left Ely by express last Monday morning, consigned to the Midvale Steel Co. of Pittsburgh. The shipment was made by the United States Tungsten Corporation, and consisted of 200 sacks, weighing 100 lbs. each, or an aggregate of about 10 tons, which will be settled for at $72 per unit under the contract which the consignees have with the steel company. Recent development work on various veins on this property has greatly improved the showing of ore, and the average daily output is now higher than at any time. About 125 men are on the payroll and general working conditions continue very favorable.

Another shipment of a ton of high-grade tungsten concentrates has just been made by Manager A. R. Shepherd from the Ophir group at Tungstonia. The new equipment is installed in the mill and has largely improved the efficiency and capacity, and as soon as the old equipment can be overhauled and placed in commission again, the mill should be able to handle about 50 tons a day. At the new excavation that was started on the vein about a month ago between the mill and the original tunnel workings, the vein has now been stripped for a length of approximately 100 ft., with a uniform width of about 30 ft. The values here are proving to be of a better average grade than in the old workings, and the new excavation is a quarry of ore that averages around 1½%. A good showing continues to be made in the new open cut, about 300 ft. above the old tunnel, and there seems every assurance that this property can continue to produce a large tonnage of ore for a long time to come. An adequate supply of water for all purposes has now been developed by a well within a short distance of the mill.

All of the equipment of the 30-ton mill of the Independent Scheelite Co. at Scheelite is now in place, and the preliminary tryouts of the mill have been very satisfactory. This is the most modern mill that has yet been erected on the Snake Range tungsten belt, all of the equipment being new and up-to-date. The various workings on the property are making a very satisfactory showing and this will undoubtedly be one of the very successful tungsten mining enterprises of White Pine county.

The Nevada Scheelite Co., operating at Minerva, has just made another shipment of about 20 tons of scheelite ore to the United States Tungsten Corporation mill at Tungsten. This company is now working about 35 men and making a large production of ore, varying from good milling to high grade. The tunnel is now being driven by two shifts to get under the splendid surface showing that was opened on the Scheelite Chief claim, a short distance above the main camp. This will give a depth of about 100 ft. on the vein. Production is being continued from the Oriole and Everett veins, both of which are making an excellent showing. Quite an important amount of high-grade concentrates is being recovered from the small testing plant at the main camp, and the general assurance of a big tungsten producer here is being strengthened every day.

It is understood that local capitalists are now figuring on building a custom mill for the purchase and concentration of ores from various prospects along the Snake range, between the camps of Tungsten and Minerva. The proposed location of the mill is near the Swallow ranch, where there is an abundant supply of water, and practically all of the ore from that section can be delivered by down-hill haul.

Tilford brothers' 3-stamp mill, located just above the camp of Scheelite, is now in steady operation and turning out about 100 lbs. of scheelite concentrates per day.

As to investments in tungsten properties, there are a large number of excellent prospects along the Snake range held by prospectors or men of limited means that can be obtained on reasonable terms, or in which working interests can be secured on a very attractive basis. With some of these owners it is a question of not having means with which to establish permanent working camps and carry on development until the properties can be placed on a paying basis, and others are open to negotiations for purchase, bond and lease and otherwise. The establishment of a custom mill at a convenient point like the Swallow ranch would give a market for ores from quite a number of the best prospects along the southern end of the range.

Announcement that officials of the Consolidated Copper Mines Co. subscribed $100,000 with which to rehabilitate the property is considered one of the most important pieces of news for this section that has been made public in a long time. This company controls the most extensive acreage of any in the district, and its property practically surrounds the Nevada Con. It is understood that the old Giroux concentrator will be remodeled and flotation process added for treating 500 tons a day, and negotiations are said to be in favorable progress for the Nevada Con. to handle a minimum of 1000 a day. Revival of this property will add several hundred men to the payroll of this district and immensely increase the output of the camp. The career of this property before and since the consolidation of the various interests now included in the holdings has been a long run of misfortune, internal dissentions and litigation, the end of which now seems to have been reached through conciliation of all factions. Identified with its management, control and as large factors have been Giroux, Cole, Ryan, Wall and others, who have seldom been in complete harmony regarding the operations of the property. Managerial, operating and financial troubles have nullified almost every effort to place this property among the copper producers. After the loss of the Giroux shaft by caving to a depth of about 1300 ft. a few years ago, the Cole management sank a new shaft of five compartments, equipped with a good hoisting plant, but at a depth of about 1000 ft. they were balked by an immense flow of water, which was followed by a fire that wrecked the shaft. In the meantime churn drilling has been conducted over a large area, with excellent results reported, and a considerable production has also been made from a portion of the property through operations of the Nevada Con., which has extended its workings into this ground for acquiring convenient access to one of the big pits where steam shovels are employed in mining the ore. In former operations of the Giroux claims large bodies of high-grade oxide ore running 25% copper were developed, and other work has proven the existence of immense deposits of sulphide ore over a large territory. If the announced plans of the company are carried out, the activities and output of the Ely district will be greatly augmented.

Searchlight.

The Quartette property has been sold to Walter M. Brown and associates This sale means a great deal for the future of Searchlight and vicinity. The property has produced more than $2,000,000 and it is considered by engineers of note that it should produce that much more.

Thompson.

For several weeks the Mason Valley Copper Co. has been conducting experiments on low-grade oxidized ore with a small leaching plant. Results have been encouraging and arrangements have been made to increase the capacity to 20 tons per day. Further experiments will be conducted before a large-scale installation is decided on. E. R. Weidlein is directing the work.

Ludwig.

The leaching plant of the Nevada-Douglas Co. has been placed in operation and is treating about 250 tons per day. Oil is used for fuel in the furnaces. The company reports a large tonnage of good-grade ore exposed and the plant is expected to prove successful in every respect.

Golconda.

Steady shipments of ore averaging 5 to 15% copper are being made from the Bull Con. Caroline mine, east of Golconda. The main ore body is said to be 20 ft. wide, with the ore averaging better than 5%; 2 carloads are shipped weekly. S. B. Kasper is managing owner.

Pioche.

The mill of the Con. Nevada-Utah Co. is treating 55 to 60 tons of ore per day and producing a zinc concentrate car-

rying some silver and an iron-lead concentrate, the latter containing considerable zinc. The percentage of zinc is being gradually lowered in the iron-lead concentrate, making a more satisfactory product; 20 to 25 tons of ore are going to the mill from the mine, the balance being drawn from the old dumps.

Reno.

The Wedge Copper Co., with headquarters in this city, is preparing to install a flotation plant at its property in the Santa Fe district, near Luning. K. Freitag, consulting engineer, has worked out a process and plans for the unit will soon be laid before the stockholders, most of whom are residents of Reading, Pa.

NEW MEXICO.

Mogollon.

The Pacific mine was recently optioned to Socorro Mining & Milling Co. by the Oaks Co. The shaft is being retimbered and other underground and surface preparations made for extensive production. An aerial wire rope tramway will be completed within 60 days, when it is proposed to ship from 50 to 75 tons of ore daily for reduction.

The company is treating over 200 tons of ore daily at the plant, with a product of around 2 tons of gold and silver bullion per month, in addition to several tons of high-grade concentrates.

The old ore dump on the Confidence mine is being sampled thoroughly with a view of shipping to one of local custom mills.

Installation of a large, double drum, electric hoist has been completed by the Ernestine Mining Co. Skips have superceded the ore buckets in shaft. The company has been a constant producer of gold and silver for over 11 years.

Development of the Eberle property is conducted by the Oaks Co. The last shipment of ore to custom mill contained 46,782 tons averaging [illegible] $795.29 in the lot.

The Oaks Co. recently took a bond and lease on the southerly half of the Clifton mine property from Socorro Mining & Milling Co. Track has been laid in tunnel, blacksmith shop erected, grizzlies installed, etc. Operations will be increased as rapidly as possible and the ore shipped to the Socorro mill.

Tyrone.

The Austin Copper Co. has recently been organized and taken over 280 acres of land in the Burro mountains. Charles Biesel, general manager of the Mines Company of America, is president, and J. M. Wiley, Silver City, N. M., is statutory agent. These, with J. W. Crowdus, T. J. Findley, R. Krakauer, W. E. Arnold and Wilbur Judson make up the directorate. The company is capitalized at $1,500,000, the shares having a par value of $1 each. It is understood that $500,000 of this is to be offered the public, the balance to be left in the treasury and remain there without options or entanglements as an asset of the company. The purchase of the property was from the Porterfield brothers and J. M. Wiley. The price paid has not been announced. The holdings are in the Burro mountains, 5 miles beyond the railroad station here, at the head of Iron creek and on the western slope of the range. These consist of 14 full claims, covering about 7000 ft. on the strike. Present lessees are shipping 300 tons per month of ore of high-grade. They have netted about $1000 per car. Shipments have averaged from 5 to 37%, the average basis being between 9 and 10% copper. The shipments have been going to the El Paso smelter, with which a contract, calling for 300 tons per month, is now in force. The Austin Co. will not operate on a small scale for the high-grade, but rather on a large scale, developing the low-grade porphyry, as at the other similar properties of the southwest. The mine was discovered in [illegible] have been rich ever since, but lack of transportation held back its development.

OREGON.

Sumpter.

Taxes on the smelter of the Northwest Smelting & Refining Co. have been allowed to lapse for several years and have accumulated to the extent of $2000. The county has foreclosed on the property and it is now in charge of Byron Weatherford.

A. H. Woodwell is doing experimental work with the flotation process at the North Pole mine. He has ordered special equipment for the work and will spend a couple of months with the ores from this property.

A. H. Weaver has discovered platinum in the black sands of his placer property on Buck gulch. In a sample which he brought east there was 17 cts. in gold and $29.22 in platinum values. A road is being constructed to the property and will have a lower grade and 3 miles less distance than the former one.

UTAH.

Modena.

Sinking at the Goldstrike Bonanza is proving satisfactory. The property is about 20 miles south of here. Gold values are now beginning to show in the shaft bottom. The shaft is being sunk on a quartz vein, and the values are in a porphyry that is beginning to show in stringers through the quartz. Operations were resumed by the company recently on the property, and the shaft will be driven down to the 100 level, after which laterals will be driven for prospecting. Four men are employed at present, and are breaking about 1½ ft. per day. Some rich ore has been mined in the district in surface workings, and the management is of the opinion that larger bodies will be developed at greater depths. The holdings of the company consist of five claims located along the strike of the vein. Plans are under way for the acquisition of more territory.

Bingham.

Word from J. A. Kauffman, president of the Bingham-Tooele Co., is that the main tunnel is in 823 ft. At the bottom of the breast the mineralization is showing much stronger, and there is spurting from the seams of the rock a much greater quantity of water than before. This indicates that the breast is nearing the objective point, which is the contact between the porphyry dike, the quartzite and the limestone formation. During the last 35 ft. of driving the tunnel has passed through lime shales and quartzite. During the progress, though the rock has been hard, a more open formation has been approached, and there has been a decided increase in the amount of water. The mineralization has also been increasing. It is believed that this water is coming from the contact between the quartzite and the Jordan limestone. Plans are under way by the company to equip the property with machine drills in the near future. To that end an air compressor will in all probability be installed, if arrangements can be made for power.

Alta.

On the ground leased by the Mines Development Co. 2 ins. of solid galena is showing in the face of the southwest drift above the raise off the main tunnel level in the Alta Tunnel and Transportation Co.'s property. The tunnel being driven south by the Alta Tunnel Co. is in 2030 ft., and the contractors are breaking 4 ft. per day. The ground under lease to the Mines Development Co. is located about 1050 ft. from the portal and is the first portion of the Alta Tunnel property in which ore was discovered. The objective of the drift to the southwest is to reach Silver Fork fault zone where it is intersected by the fissure that is being followed to the southwest. The body being followed in that direction has shown a steady improvement both in size and values. It is believed that a body of commercial ore will be encountered when the fault zone is reached. At the point where the fissure that is being followed intersects the fault a depth of 800 ft. on the vertical from the surface will be attained. Lying

a few feet to the south of the fissure is a porphyry dike which the fissure will intersect, and this dike is believed to be the magma which carried the primary metal, and it is possible that a segregated body may be found there.

The Wasatch Mines Co. is now installing machinery for driving its new tunnel. The tunnel will be used for transportation and drainage. The length will be about 4000 ft., and it will, besides draining the property, give an additional depth below the 400 level of 300 ft. The machinery consists of two Ingersoll-Rand air compressors that will each deliver 480 cu. ft., the necessary air drills, machine steel, a sharpening machine, blacksmith outfit, the pipe, etc. The buildings that will house the machinery will be erected on the extreme southwestern portion of the property near the portal of the tunnel. The property contains 900 acres, and the tunnel will be driven north 60° east. It will drain the property of the company, as well as a number of neighboring properties, and will make available a large tonnage of ore now below the water level. The cost has been estimated at $60,000. Two shifts are to be employed, and it will be driven ahead at the rate of 10 ft. per day. With two shifts it is believed that not less than 300 ft. per month will be made, and in the event that it is found practical to use three shifts a rate of 450 ft. will be made.

Park City.

Silver King Con. is adding to its transportation and milling equipment. Work is under way on the erection of a 300-ton tramway to connect the mines with the mill now under construction here. All smelter ore will be sorted from mill ore at the mine and delivered to separate bins at the mill. Smelter ore will be crushed and sampled mechanically preparatory to shipment. The mill equipment, including crushers for the ore, is being furnished by the Traylor Engineering & Mfg. Co. A series of tests extending over several months were made on the ores, and the mill when in operation will turn out a lead concentrate and a commercial zinc product. The iron in the ore may go with the lead concentrates or may be shipped as a separate product. The crushing will be to 16-mesh on Traylor non-corrugating rolls. At this size it will be given its first concentration. The middlings requiring regrinding will be taken to a tube mill operating with pebbles. Flotation will be used in the treatment of the slimes, and this will be followed by a selective flotation which has been worked out for the separation of the iron from the zinc in the flotation concentrates. The different table concentrates will be delivered to concentrate bins along the railroad. All products will be handled mechanically, the ore being fed from the bins by means of apron feeders over grizzlies to the crushers. Concentrates instead of being handled in cars and wheelbarrows will go direct to pumps and be elevated to settling bins. The slime concentrates will be filtered and elevated by means of conveyors to the bins along the railroad.

Eureka.

Work has been started on the main shaft of the Paloma Extension. Considerable surface investigating was done before the site was selected. The shaft will be driven a distance of 200 ft. as rapidly as possible. Officials are of the opinion that ore will be developed in paying quantities within this distance. Cropping on the property and within 100 ft. west of the new shaft is the quartz monzonite formation, which formation, according to the U. S. G. S., is responsible for the ore deposition of the San Francisco and adjacent districts. The quartz monzonite is in contact with the limestone and the quartzite. On Paloma Extension the monzonite strikes northeast and southwest and dips southeast. The quartzite strikes east and dips north. The limestone strikes north and dips east. Cutting the contacts between these formations are the ore-bearing fissures that strike northeast, and it is believed that in the vicinity of where the fissures intersect the contacts bodies of ore will be developed.

WASHINGTON.

Spokane.

The Rockcut gold strike in Stevens county is a rich showing, but its value depends entirely on the extent of the ledge holding the high-grade quartz, said E. J. Merrin, mining operator of Spokane, who, with H. H. Fetter of Orient, visited the new gold find, near Orient, on the Great Northern railroad.

The Day brothers, controlling factors in the Northport Smelting & Refining Co., operating a smelter at Northport, and the Hercules and Tamarack & Custer Con. Mining companies in the Coeur d'Alenes, are negotiating for purchase of the Lamefoot group, near Curlew, according to Jacob Goetz, one of the original owners of the Bunker Hill & Sullivan mines. Goetz, who is representing the Spokane interests in the negotiation, states that Jerome J. Day, president and general manager of the smelting company and the Tamarack & Custer Co., with one of his engineers, recently made an exhaustive examination of the Lamefoot holdings. The group was under bond for several years to the Granby Smelting Co., which did extensive diamond drill exploration, and it is said that bodies of iron ore, carrying good gold values, were located. The material is said to be an excellent combination for fluxing purposes, and its proximity to the Northport smelter will make the mine particularly desirable.

WISCONSIN-ILLINOIS.

Linden.

The Linden Zinc Co. shipped 6 cars of high-grade separator product to Lanyon Zinc Co., 240 tons. Several more cars were ready for immediate delivery. Ross Bros., 1 car to Mineral Point Zinc Co., 26 tons. Saxe-Pollard Co., to Mineral Point, 3 cars, 105 tons; 5 cars to Linden Zinc Co., 200 tons. Option taken recently on the Saxe-Pollard mines for which a cash bonus was paid is being exercised, and several drilling machines are engaged in checking up deposits. At one point ore in new ground was located 30 ft. in thickness.

Mifflin.

Peacock mine is shipping. The Lucky Six delivered 1 car to La Salle, 40 tons; Biddick mine to Benton Roasters, 2 cars, 80 tons; Coker mines to Mineral Point Zinc Co., 7 cars, 281 tons; Rundell mine to Cuba separators, 2 cars, 87 tons. Rapid headway is noted in the construction of a new 200-ton milling plant for the M. & A. Mining Co. Several hundred tons of low-grade are have been carried over by six independent operating companies located in this district.

Mineral Point.

Receipts of low-grade ore at the separating plants of the New Jersey Zinc Co. for last week totaled 27 cars, 1010 tons; refined product to smelter at DePue, 16 cars, 593 tons. Locals delivered small lots to furnace.

Montfort.

The O. P. David mine shipped 1 car to La Salle last week, 35 tons. The company in control is about to close a deal pending the exercise of an option for the purchase of mine and equipment.

Cuba.

National Separators for week of June 10 report receipt of 18 cars of crude ore, 791 tons. Shipments of high-grade to Illinois Zinc Co., 3 cars, 107 tons; Edgar Zinc Co., 3 cars, 110 tons; Granby Mining & Smelting Co., 5 cars, 193 tons; Utt-Thorne Mining Co. to separators at Benton, 44 tons.

Platteville.

Homer S. Snow, general manager for the Wisconsin Zinc Co., has been appointed traffic manager for the American Zinc, Lead & Smelting Co., with offices in room 1012 Pierce Bldg., St. Louis. H. C. George, a graduate and instructor of the Pennsylvania School of Mines in the employ of the Wisconsin Zinc Co., for many years, has been appointed his successor.

Shipments covering the entire field for the week of June 10 included 119 cars zinc ore, 4835 tons; 3 cars of lead ore, 235,700 lbs. The National Separators at Cuba were the only firm shipping pyrites, 573,600 lbs. going to General Chemical Co. The gross yield of crude concentrate from all mines amounted to 3405 tons; net deliveries to smelter, 2629 tons.

The base price of zinc ore remained [illegible] week preceding, $77@78 for top grades, down to $70 for seconds and medium grades. The situation with regard to low-grade producers remained unchanged, and much concentrates are being carried over. Locals to report shipments were the Klar-Piquette, 43 tons; East End, 38 tons; Hodge to Cuba, 3 cars, 130 tons; West Hill to La Salle, high-grade, 57 tons; Star mine to La Salle, 44 tons.

Benton.

Shipments last week were reported by the Frontier Co., 7 cars, 312 tons, to Grasselli Chemical Co.; New Jersey Zinc Co. to Mineral Point, 6 cars, 255 tons; Fields Mining & Milling Co. from Crawhall and Thompson mines, 6 cars, to Galena Refinery Co., 260 tons; Vinegar Hill Zinc Co. from the Blackstone, Martin and Kittoe mines, 11 cars, 501 tons; Indian Mound Mining Co., 2 cars, to Lanyon Zinc Co., 65 tons; Benton Roaster Co. to La Salle, 2 cars, 91 tons; Wisconsin Zinc Roasters from Skinner separating plant at New Diggings, 4 cars to La Salle, 160 tons; 3 cars to Lanyon Zinc Co., 129 tons; Champion mine to Galena Wisconsin Zinc Co., 2 cars, 92 tons. Total, 43 cars, 3,730,000 lbs.

On the Calvert mine much ore is coming from the west end of the range. More miners and laborers are in demand here. The output at present is 200 tons concentrates weekly. On the Hird, a new producer, a force of miners abandoned drifts on range to northwest on account of damp, and two drifts are being driven around the deposit to the southwest. One car of 30% ore was made last week in a trial run of the new 300-ton equipment. It will be another 30 days before the mill will be running on full time. The ore will not be high-grade, but uniform. On the Grotkin lease an east and west range has been cut, driving across the path of the 10 O'Clock run now being mined. Flat sheets undetermined in length and width, 2 to 4 ins. thick, have been located. Two good borings have been located with drill on the Joe Carey lease. A new run of ore has been picked up with drills 120 ft. north of the old Calvert mine. The range has not been tested to see if it is a 2 O'Clock coming though this tract. Five good drill holes were secured on the James Calvert farm south of the railway tracks and 300 yds. from the Temple farm line.

At the Bull Moose a production is maintained of 240 tons of concentrates weekly, 42% up. The range is being opened up to the south side of the farm, where drills show the deposit unusually thick and rich. A new modern power and milling plant will be supplied here in the near future. On the Treganza mine, a new producer, the range has widened and is now 200 feet across, and in places stopes are being driven 40 feet high. From 200 to 240 tons of 45% ore is being made weekly.

Hazel Green.

The Kennedy mine, one of the oldest continuous producers in the field for 22 years, is producing again, last week shipping 6 cars to Mineral Point, 219 tons; Cleveland mine to Mineral Point, 4 cars, 113 tons; Lawrence mine to Wisconsin Zinc Co. at Galena for separation, 3 cars, 120 tons. No returns were reported from the Potosi district. From the Shullsburg camp 1 car of low-grade ore came from the Wisnkill mine to Wisconsin Zinc Co., Galena, 50 tons.

Galena.

Galena Refinery Co., high-grade separator product to Granby smelters, 4 cars, 160 tons; to La Salle, 40 tons; Federal mine to Wisconsin Zinc Co.'s roasters, 2 cars, 82 tons; North Unity to Cuba, 2 cars, 73 tons; Wisconsin Zinc Roasters to La Salle, 5 cars, 62% zinc ore, 200 tons.

WYOMING.

The U. S. Geological Survey has just published a report presenting information obtained by A. C. Spencer, geologist, in a reconnaissance of the Atlantic gold mining district, in Freemont county, and parts of the North Laramie mountains, in Converse and Albany counties. The history of mining in the Atlantic district dates from the early forties, but there was no extensive development until about 1867. By 1871 the principal veins of the district were located and 12 stamp mills had been erected. Up to 1873 the gold production of the district appears to have [illegible] from $[illegible]; the best available data indicate that the value of the total output does not exceed $1,500,000. Since 1873 interest in the Atlantic district has been maintained largely through recurring attempts to reopen certain of the previously productive mines. Though the immediate outlook for a general revival of gold mining in the Atlantic district is not encouraging, the belief that the stronger gold-bearing veins persist in depth with about the same characteristics that they have near the surface raises the hope that with multiple development of deposits and well-planned methods the early promise of the region may yet be fulfilled. This problem, which involves the planning and execution of development work, methods of ore treatment, transportation and cost of power, is discussed by Spencer. Although more or less work has been done at one place or another since about 1875, mining in the North Laramie mountains remains in the prospecting stage. In recent years the search has been chiefly for copper ores, but the results have been disappointing, and the geologist concludes that there is little chance of discovering really extensive copper deposits. Some small deposits may be mined, but, in general, the outlook is not very encouraging. Deposits of magnetite, chromite and asbestos are known, but none has been profitably worked. In both regions the lode deposits occur in schists of pre-Cambrian age, partly with quartz in distinct fissures and partly as tabular or lenticular bodies of rock through which the sulphides are distributed. These bodies are aligned in more or less definite belts in the schists. Details of the geology of the general region, as well as of each of the two areas, are given, and the character of the veins and mineral occurrences are discussed individually and collectively. The report, which is published as Bulletin 626, is called "The Atlantic gold district and the North Laramie Mountains," and can be obtained free on application to the Director, U. S. Geological Survey, Washington, D. C.

Atlantic.

H. H. Armstead, who has been developing gold property near here, has decided to erect a mill. While the details of the mill he expects to erect at Lewiston have not been given out, it is to have 200 tons capacity, with the latest cyanide processes. The ore in the district has in the past been difficult to handle, but on a test run last summer Armstead made a high percentage of extraction. Power will be furnished by a new hydro-electric plant, which has recently been financed through O. M. Beck and will be placed on the Little Popo Agie property.

Lauder.

The Midwest Co. is reported as having declared its location to be too far west. In fact, the men in the Pilot field are now coming more to think that the government geologists were right in their conclusions. Lately the big companies are reported to be trying for leases on the east side. For this reason the Midwest Co. drilling with a standard on the bench is moving its rig to the Heslin property, which it holds under lease. The hole was on the west side of the field and down 1500 ft. with no encouraging results.

The Ohio Oil Co. has shipped a standard drilling rig here which is being hauled out to the Sage creek, north of Fort Washakie. It has taken over under lease a part of the land held by W. H. Dickenson and associates and will put down at least two wells this summer. The exact location has not been decided upon, but will be probably north and east of the Harnsberger asphalt well, 3 miles north of Fort Washakie.

CANADA.

BRITISH COLUMBIA.

Trail.

The Consolidated Mining & Smelting Co. of Canada, which owns and operates the Le Roi, War Eagle and Centre Star groups of copper-gold mines at Rossland, lead-silver-zinc properties near Ainsworth and similar holdings in northern Washington, together with an immense smelting and refining works at Trail, on July 31 will pay the second quarterly dividend of the current year. The declaration will be

$2.50 a share on the issued capitalization of $209,830, making the payments $419,660 for 1916 and increasing the grand total to $2,884,911. The company is credited with having the most complete and modern reduction works in the world at Trail, and important betterments to the different departments are being added constantly. It operates extensive copper and lead furnaces at the smelter, and recently an electrolytic zinc smelter and refinery was put in service. It already had an electrolytic lead refining plant operating, and a copper refinery, adequate to treat the capacity output of the copper furnaces, now is being constructed at a cost of not less than $1,000,000.

Nelson.

California capitalists have taken a bond on a group of claims on Bayonne mountain, in the Sheep creek district, south of here, agreeing to pay $140,000 for 22 claims. The deal was made through J. McNichol of Butte. The claims include five groups, all of which are said to have rich showings in free-milling gold. Several Nelson persons are included in the list of owners, Alexander Stewart and William Maher holding the largest interests. The groups bonded are the Topay, Vanguard, Josephine, Jack Pot, and the Ray and Jessie. McNichol has just taken a bond on the Silver Leaf claim, a promising silver-lead property on Payne mountain in the Slocan, owned by M. C. Monahan and F. Snyder of Spokane. The consideration is not stated.

Ainsworth.

Considerable attention has been attracted to the Blue Bell peninsula on the east side of Kootenay lake, almost opposite Ainsworth, by the recent opening of a large surface showing of galena on the Comfort claim owned by A. D. Wheeler of Ainsworth. He started work and opened the ore body about 5 weeks ago. Wheeler has stripped a considerable area and uncovered an ore streak which yielded 125 tons of silver-lead ore which gave smelter returns of 40% lead and 15 ozs. silver. The Comfort group lies north fo the Blue Bell mine and consists of two claims and is entirely surrounded by ground that is the property of the new Canadian Metal Co., the corporation operating the Blue Bell. Concentrates are coming steadily from the Blue Bell, both mine and mill running three shifts, the largest crew of any mine in the Ainsworth district. The main incline shaft has been put down 130 ft. further from the C, or hitherto lowest tunnel, and from the development accomplished on D level the inference is reached that the ore bodies are undiminished either in value or size at a further depth. It is estimated that the opening of the level will leave enough ore at the disposal of the company to operate the mill steadily for a year or a year and a half.

Salmo.

A remarkable tonnage of zinc-carbonate ore is being developed in the Hudson Bay mine, recently acquired by the Hayden-Stone-Jackling syndicate of New York, according to Maurice W. Bacon, formerly general manager of the Stewart Mining Co., who, with W. E. Cullen and other Spokane men, incorporated the Hudson Bay Zinc Mines Co. and negotiated the sale of the property to the New York interests for approximately $1,125,000. "There has been no change in the character of the ore that we have opened since taking over the mine several months ago," said Bacon. "Our shipments continue to average 29 to 30% zinc, which is an unusually high-grade carbonate to be found in such immense bodies. We also have proven the ore bodies to be much wider than they were believed to be when the property was under development several years ago by the Consolidated Mining & Smelting Co. of Canada as a lead-silver mine. The long crosscut tunnel, which will tap the vein about 1800 ft. in at a vertical depth of 1750 ft., now is advanced about 600 ft., and we expect to have it completed by September. We are shipping about 60 tons daily, mostly from development work, but now that the condition of the wagon road has improved we hope to maintain an average output of 75 tons daily until we get our hydro-electric station, concentrator and railway to Salmo completed."

Argenta.

An option has been secured by D. E. Wick on the St. Patrick group, located on Lavina mountain, just north of here, the vendors of the property being A. LeBlanc and Jean Brochier of Kaslo. The papers were signed Friday. The property has been worked all winter and spring. Development to date consists of a 200-ft. tunnel on the main ledge and a 90-ft. shaft. The ore body opened up consists of a 6-in. and an 18-in. streak of galena and zinc, carrying good values, some of it assaying as high as 77% lead. The main ore body consists of lower grade mixture of galena and zinc, suitable for milling, and reported by the owners to be 36 ft. in width where it has been opened. Wick represents Minneapolis capital. The property is situated conveniently close to water transportation at the north end of Kootenai lake.

ONTARIO.

Cobalt.

The contract for deepening of the shaft of the People's Mining Co. has been given to J. McGuire. The contract calls for the sinking of the shaft from the present 310 level to the contact, a distance of 250 ft. and the cutting of a station at a distance of 450 ft. The cost of the work will be borne jointly by the People's Mining Co. and the Ophir Mining Co. Both companies will operate through this shaft. At the depth of 560 ft. they will crosscut to the vein and then drift to the boundary. After this point has been reached all further expenses will be handled separately.

The objective of sinking at the Beaver mine has been reached and is the contact between the lower side of the diabase sill and keewatin. It was reached at 1630 ft. and a station is now being cut at the 1600 level from which level all exploration work will be carried on. About 18 days will be required to make the necessary timbering and installation before starting any lateral development work. Some time ago President Culver gave the theory that as Beaver's big values were found at the upper contact, between the diabase and keewatin, and as the big values of mines farther south were at the lower contact, that is, below the diabase, the chances were that rich ore bodies would be found there in Beaver also. It was from this that he set to sinking the shaft through the diabase sill to the keewatin contact below, intending, once that was reached, to explore from there for the ore bodies he expects to find.

Porcupine.

An account of the address to the stockholders of the McIntyre Co. is as follows: Details were given of the two finds made recently at the 700 and 1000-ft. levels. The former is 62 ft. wide and valued at $14 per ton. It has been extended 140 ft. each way, and continues in rich ore. The latter is 25 ft. wide and is valued at $15.30 per ton. Ore reserves show a substantial increase. On March 31, 1916, there were 202,000 tons, valued at $11 per ton, or $2,247,000, as against 109,000 tons, valued at $854,000, a year ago. This did not include the strike at the 1000 level mentioned above, and while that at the 700 level was included, it was estimated on the basis of only a width of 11 ft. Five miles of underground work has been completed on the property. The body of ore on the McIntyre has now been developed on the 700-ft. level for 160 ft. and faces are still good. This is the ore body that showed 62 ft. of $14 ore.

As a result of close observation and much testing, all stamps at the Dome Mines, Ltd., will be replaced with Hardinge ball mills. The company has ordered three new 8-ft. by 30-in. mills and as soon as these are delivered the stamps in use will be taken out. Each of these mills occupy only the space formerly taken by 10 stamps, having a capacity of not to exceed, with wide open screens, 80 tons. It is shown that the same space, with ball mills, can crush 500 to 600 tons. Extensive improvements are under way at the mines. The new steel headframe and hoist for the central 6-compartment shaft will be completed by June 25, after which the company will have a hoisting capacity far above its present needs.

Swastika.

With the discontinuing of underground development at the Lucky Cross mine, which is under option to the Trethewey Co., attention will be given chiefly to surface work, in the way of trenching and test-pitting. As the Lucky Cross Co. owns a large number of claims there is a large area to prospect. The old property near the town will probably be started up this week. Considerable preliminary work remains to be done here and will require at least a couple of days before active work can be started.

World's Index of Current Literature

A Weekly Classified Index to Current Periodical and other Literature, Appearing the World Over Relative to Mining, Mining Engineering, Metallurgy and Related Industries, in Four Parts.

Part 1. *Geology*—(a) Geology; (b) Ore Genesis; (c) Mineralogy.

Part 2. *Ores and Metals*—(a) Metals and Metal Ores; (b) Non-Metals.

Part 3. *Technology*—(a) Mines and Mining; (b) Mill and Milling; (c) Chemistry and Assaying; (d) Metallurgy; (e) Power and Machinery.

Part 4. *General Miscellany* (including Testing, Metallography, Waste, Law, Legislation, Taxation, Conservation, Government Ownership, History, Mining Schools and Societies, Financial, etc.

Articles mentioned will be supplied to subscribers of Mining and Engineering World and others at the prices quoted. Two-cent stamps will be received for amounts under $1. Subscribers will be allowed a discount of 5 cts. if the price of the article exceeds 50 cts. The entries show:

(1) The author of the article.

(2) A dash if the name is not apparent.

(3) The title, in italics, of the article or books. Titles in foreign languages are ordinarily followed by a translation or explanation in English.

(4) When the original title is insufficient a brief amplification is added. This addition is in brackets.

(5) The journal in which the article appeared; also the date of issue, and the page on which the article begins.

(6) Number of pages. Illustrated articles are indicated by an asterisk (*).

(7) The price.

I. GEOLOGY

GEOLOGY AND MINERALOGY

Geology

Alsdorf, P. R.—*Occurrence, Geology and Economic Value of the Pitchblende Deposits of Gilpin County, Colorado.* [Radium is the principal economic mineral and uranium oxide the main constituent. The deposits and operation of the same are described].—Eco. Geol. May 1916; p 266; pp 13; 60c.

Daly, R. A.—*Geology of the Kiruna District, Sweden.* [Brings out a theory other than magmatic segregation of the deposits in the quartz porphyry].—Eco. Geol. May 1916; p 294

Drysdale, C. W.—*Geology and Ore Deposits of Rossland, British Columbia.* [General and economic geology are reviewed in detail. Separate descriptions of mines are given and part II is on physiography of the district].—Canadian Geol. Surv. Mem. 77; pp 317*.

Fitch, R. S.; Loughlin, G. F.—*Wolframite and Scheelite at Leadville, Colorado.* [The geology of the formation containing these minerals is described, and the mineralogy and occurrence of the minerals taken up separately; from Eco. Geol.].—Mg. World June 3 1916; p 1039; pp 1¾; 10c.

Gregory, H. E.—*Garnet Deposits on the Navajo Reservation, Arizona and Utah.* [Geology, distribution and occurrence are the principal items of the article].—Eco. Geol. May 1916; p [illegible] 8*; 60c.

Lupton, C. T.—*Geology and Coal Resources of Castle Valley in Carbon, Emery and Sevier Counties, Utah.* [The land is to be reopened to entries. Coal from 8000 to 14,000 B. T. U. value is found. General geology of the formation and separate descriptions of the different seams are given].—U. S. G. S. Bull. 628; pp 8*; 30c.

Morgan, P. G.; Bartrum, J. A.—*The Geology and Mineral Resources of the Buller-Mokihinui Subdivision, Westport Division, New Zealand.* [N. Z. Geol. Surv., Wellington; Bull. No. 17; pp 210*; 75c.

Pratt, W. E.—*The Occurrence of Petroleum in the Philippines.* [Speaks of several occurrences of petroleum and describes the stratigraphy. Analyses of the oils are given].—Eco. Geol. May 1916; p [illegible] pp [illegible] 60c.

Tomlinson, C. W.—*The Origin of the Red Beds.* [Many of our ore deposits are found in this formation in both the north and southwestern states].—Jnl of Geol. May 1916; p [illegible] pp 15; 75c.

Uglow, W. L.—*Ore Genesis and Contact Metamorphism at the Long Lake Zinc Mine, Ontario.* [Descriptions of the rocks and minerals, their distribution and genesis are given in connection with a description of the surrounding formation].—Eco. Geol. May 1916; p 231; pp 15*; 60c.

[illegible] *ical Survey, Department of Mines, Canada,* 1915. [In one volume separate reports made during the year on different districts and topics are given].—Canadian Geol. Surv. Sessional Paper 26; pp 307*.

Ore Genesis

Daly, R. A.—*Geology of the Kiruna District, Sweden.* [Brings out a theory other than magmatic segregation of the [illegible] Geol. May 1916; p 294.

Tomlinson, C. W.—*The Origin of the* [illegible] [Many [illegible] ore deposits are found in this formation in both the north and southwestern states].—Jnl. of [illegible]

Uglow, W. L.—*Ore Genesis and Contact Metamorphism at the Long Lake Zinc Mine, Ontario.* [Descriptions of the rocks and minerals, their distribution and genesis are given in connection with a description of the surrounding formation].—Eco. Geol. May 1916; p 231; pp 15*; 60c.

Mineralogy and Petrography

Drysdale, C. W.—*Geology and Ore Deposits of Rossland, British Columbia.* [General and economic geology are reviewed in detail. Separate descriptions of mines are given and part II is on [illegible] Canadian Geol. Surv. Mem. 77; pp 317*.

Fitch, R. S.; Loughlin, G. F.—*Wolframite and Scheelite at Leadville, Colorado.* [The geology of the formation containing these minerals is described, and the mineralogy and occurrence of the minerals taken up separately; from Eco. Geol.].—Mg. World June 3 1916; p 1039; pp 1¾; 10c.

Jenkins, O. P.—*Phosphates and Dolomites of Johnson County, Tennessee.* [The geologic history, mineralogy, occurrence analyses of samples and geological structure of the country, are all considered].—Res. of Tenn. April 1916; p [illegible] pp [illegible]

——— *Summary Report of the Geological Survey, Department of Mines, Canada,* 1915. [In one volume separate reports made during the year on different districts and topics are given].—Canadian Geol. Surv. Sessional Paper 26; pp [illegible]

II. ORES AND METALS

(I) METALS AND ORES

Copper

Barnitz, H. L.—*The Technical Produc-* [illegible] *plication.* [Reprint from Met. & Chem. [illegible] drogen flame for welding. Several different processes are described in general and some details given].—Barnitz, New York, pp [illegible]

Martin, A. H.—*The Flotation Process at Goldfield, Nevada.* [A concise detailed description of the plant, equipment, operation and results obtained. Callow pneumatic flotation cells are used].—Mg. World June 3 1916; p 1041; pp 1¼; 10c.

[illegible] *Canada,* 1915. [In one volume separate reports made during the year on different districts and topics are given].—Canadian Geol. Surv. Sessional Paper 26; pp 307*.

Gold Fields and Mining

Blackstone, R.—*The Homestake Mine, South Dakota.* [Notes on the history of its development, discovery and operation, including many of the prices paid for options and sales of claim [illegible]

make up the entire property].—Pahasapa June 1916; p 16; pp 15*; 30c.

Bochert, W. C.—*Review of Mining Operations in the Northern Hills, South Dakota.* [The history and production of the gold, silver and tungsten properties of the state are reviewed in detail, though briefly]. Pahasapa June 1916; p 49; pp 5*; 30c

Drysdale, C. W.—*Geology and Ore Deposits of Rossland, British Columbia.* [General and economic geology are reviewed in detail. Separate descriptions of mines are given and part II is on physiography of the district].—Canadian Geol. Surv. Mem. 77; pp 317*.

Martin, A. H.—*The Flotation Process at Goldfield, Nevada.* [A concise detailed description of the plant equipment, operation and results obtained. Callow pneumatic flotation cells are used].—Mg. World June 3 1916; p 1041; pp 1¼; 10c.

Scott, W. A.—*Present Development of the Oatman District, Arizona.* [An account of the district, its operating companies and their operations, results and present stage of development].—Mg. World June 3 1916; p 1033; pp 5¼*; 10c.

Seaman, W. Y.—*The Lure of Cripple Creek Gold.* [A historic and current account of the gold deposits in this district. Production figures and descriptions of how many of the larger mines were discovered are given].—W. Y. Seaman, Denver; pp 48; 25c.

Willard, C. G.—*The Golden Reward Roaster, South Dakota.* [A brief description with details on the crushing and roasting of the ores preliminary to cyanidation. Sulphur is reduced from an average 6% to less than 1%].—Pahasapa June 1916; p 40; 6*; 30c.

Yates, B. C.—*New Construction Work at the Homestake, South Dakota.* [A brief but detailed description of the new steam auxiliary electric station and skip hoist. The central steam plant, electric generating plant and hoist are included].—Pahasapa June 1916; p 31; pp 4; 30c.

——— *Summary Report of the Geological Survey, Department of Mines, Canada,* 1915. [In one volume separate reports made during the year on different districts and topics are given].—Canadian Geol. Surv. Sessional Paper 26; pp 307*.

Gold Milling, Metallurgy, Etc.

See Mill and Milling, Metallurgy, Chemistry, Assaying, Etc.

Iron and Steel

Barnitz, H. L.—*The Technical Production of Hydrogen and Its Industrial Application.* [Reprint from Met. & Chem. Engg. It is used to make the oxy-hydrogen flame for welding. Several different processes are described in general and some details given].—Barnitz, New York; pp 11; 30c.

Cone, E. F.—*Steel Castings and Physical Properties.* [Gives results of static tests and shows that micrographs prove that these tests are not always to be relied on].—Iron Age June 1 1916; p 1310; pp 3½*; 30c.

Iron and Steel: Foundry and Furnace Practice

[illegible] *Process.* [A talk on various methods employed in the process, with a practical talk on the theory of the same].—Valve World June 1916; p [illegible]; pp [illegible]; [illegible]

Vreeland, G. W.—*Distribution of Raw Materials in the Blast Furnace.* [A paper read before the Amer. Iron & Steel Inst. The information is given as the result of many tests. Suggestions are also given regarding charging as it is related to the correct distribution of materials. Many of the test results are plotted on curves].—Iron Age June 1 1916; p 1332; pp 6*; 30c.

——— *Powdered Coal Utilization at Lebanon, Pa.* [Waste-heat boilers are used in conjunction with open-hearth furnaces by the American Iron & Steel Mfg. Co. Details and drawings of their coal crushing plant are given].—Iron Age June 1 1916; p 1317; pp 2¼*; 30c.

Lead

Drysdale, C. W.—*Geology and Ore Deposits of Rossland, British Columbia.* [General and economic geology are reviewed in detail. Separate descriptions of mines are given and part II is on physiography of the district].—Canadian Geol. Surv. Mem. 77; pp 317*.

——— *Summary Report of the Geological Survey, Department of Mines, Canada,* 1915. [In one volume separate reports made during the year on different districts and topics are given].—Canadian Geol. Surv. Sessional Paper 26; pp 307*.

Radium and Radio-Actives

Alsdorf, P. R.—*Occurrence, Geology and Economic Value of the Pitchblende Deposits of Gilpin County, Colorado.* [Radium is the principal economic mineral and uranium oxide the main constituent. The deposits and operation of the same are described].—Eco. Geol. May 1916; p 266; pp 13; 60c.

Silver

Bochert, W. C.—*Review of Mining Operations in the Northern Hills, South Dakota.* [The history and production of the gold, silver and tungsten properties of the state are reviewed in detail, though briefly].—Pahasapa June 1916; p 49; pp 5*; 30c.

Drysdale, C. W.—*Geology and Ore Deposits of Rossland, British Columbia.* [General and economic geology are reviewed in detail. Separate descriptions of mines are given and part II is on physiography of the district].—Canadian Geol. Surv. Mem. 77; pp 317*.

——— *Summary Report of the Geological Survey, Department of Mines, Canada,* 1915. [In one volume separate reports made during the year on different districts and topics are given].—Canadian Geol. Surv. Sessional Paper 26; pp 307*.

Silver Milling, Metallurgy, Etc.

See Mill and Milling, Metallurgy, Chemistry, Assaying, Etc.

Tungsten

Bochert, W. C.—*Review of Mining Operations in the Northern Hills, South Dakota.* [The history and production of the gold, silver and tungsten properties of the state are reviewed in detail though briefly].—Pahasapa June 1916; p 49; pp 5*; 30c.

Fitch, R. S.; Loughlin, G. F.—*Wolframite and Scheelite at Leadville, Colorado.* [The geology of the formation containing these minerals is described, and the mineralogy and occurrence of the minerals taken up separately; from Eco. Geol.].—Mg. World June 3 1916; p 1039; pp 1¾; 10c.

Nevius, J. N.—*Notes on the Randsburg Tungsten District, California.* [A brief description, including mines and their operation, geology and discussion].—Mg. & Oil Bull. May 1916; p 126; pp 3*; 25c.

Uranium

Alsdorf, P. R.—*Occurrence, Geology and Economic Value of the Pitchblende Deposits of Gilpin County, Colorado.* [Radium is the principal economic mineral and uranium oxide the main constituent. The deposits and operation of the same are described].—Eco. Geol. May 1916; p 266; pp 13; 60c.

Zinc

Daly, R. A.—*Geology of the Kiruna District, Sweden.* [Brings out a theory other than magmatic segregation of the deposits in the quartz porphyry].—Eco. Geol. May 1916; pp 294.

Drysdale, C. W.—*Geology and Ore Deposits of Rossland, British Columbia.* [General and economic geology are reviewed in detail. Separate descriptions of mines are given and part II is on physiography of the district].—Canadian Geol. Surv. Mem. 77; pp 317*.

Spring, L. W.—*The Open Hearth Process.* [A talk on various methods employed in the process, with a practical talk on the theory of the same].—Valve World June 1916; p 197; pp 8¼*; 20c.

Uglow, W. L.—*Ore Genesis and Contact Metamorphism at the Long Lake Zinc Mine, Ontario.* [Descriptions of the rocks and minerals, their distribution and genesis are given in connection with a description of the surrounding formation].—Eco. Geol. May 1916; p 231; pp 15*; 60c.

Vreeland, G. W.—*Distribution of Raw Materials in the Blast Furnace.* [A paper read before the Amer. Iron & Steel Inst. The information is given as the result of many tests. Suggestions are also given regarding charging as it is related to the correct distribution of materials. Many of the test results are plotted on curves].—Iron Age June 1 1916; p 1332; pp 6*; 30c.

(I) NON-METALS

(A) FUELS

Coal Fields and Mining

Grady, W. H.—*Selecting and Buying Fuel.* [Charts, tables, description and discussion having to do with the selection of any class of fuel so as to get a minimum cost per ton. Heat value of the fuel and situation of the product with respect to the user are the main points].—Amer. Wood Preservers' Assn. 1916 Report; p 91; pp 14*; 35c.

Lupton, C. T.—*Geology and Coal Resources of Castle Valley in Carbon, Emery and Sevier Counties, Utah.* [The land is to be reopened to entries. Coal from 8000 to 14,000 B. T. U. value is found. General geology of the formation and separate descriptions of the different seams are given].—U. S. G. S. Bull. 628; pp 88*; 30c.

Morgan, P. G.; Bartrum, J. A.—*The Geology and Mineral Resources of the Buller-Mokihinui Subdivision, Westport Division, New Zealand.*—N. Z. Geol. Surv., Wellington; Bull. No. 17; pp 210*; 75c.

——— *Ford Collieries Co., New No. 3 Mine, Pennsylvania.* [After a general description of the surface, equipment and power plant methods of cutting and haulage are taken up].—Elect. Mg. April 1916; p 33; pp 18*; 20c.

——— *Powdered Coal Utilization at Lebanon, Pa.* [Waste-heat boilers are used in conjunction with open-hearth

furnaces by the American Iron & Steel Mfg. Co. Details and drawings of their coal crushing plant are given].—Iron Age June 1 1916; p 1317; pp 2[illegible]*

——— *Summary Report of the Geological Survey, Department of M[illegible] Canada,* 1915. [In one volume separate reports made during the year on different districts and topics are given].—Canadian Geol. Surv. Sessional Paper 26; pp 307*.

Peat

Morgan, P. G.; Bartrum, J. A.—*The Geology and Mineral Resources of the Buller-Mokihinui Subdivision, Westport Division, New Zealand*—N. Z [illegible] Surv., Wellington; Bull. No. 17; pp 210*; 75c.

Petroleum

Arnold, Ralph.—*Conservation of the Oil and Gas Resources of the Americas.* [The occurrence and production from all the fields is discussed, with their reserves, so as to bring out the subject of conservation. Qualities of the various products are also given].—Eco. Geol. May 1916; pp 203; pp 20; 60c.

Doheny, E. L.—*The Mexican Petroleum Co., Ltd.* [A description of the company, its development, operations, etc.].—Mg. & Oil Bull. May 1916; p 130; pp 5*; 25c.

Grady, W. H.—*Selecting and Buying Fuel.* [Charts, tables, description and discussion having to do with the selection of any class of fuel so as to get a minimum cost per ton. Heat value of the fuel and situation of the product with respect to the user are the main points].—Amer. Wood Preservers' Assn. 1916 Report; p 91; pp 14*; 35c.

Pratt, W. E.—*The Occurrence of Petroleum in the Philippines.* [Speaks of several occurrences of petroleum and describes the stratigraphy. Analyses of the oils are given].—Eco. Geol. May 1916; p 246; pp 20*; 60c.

Natural Gas

Arnold, Ralph.—*Conservation of the Oil and Gas Resources of the Americas.* [The occurrence and production from all the fields is discussed, with their reserves, so as to bring out the subject of conservation. Qualities of the various products are also given].—Eco. Geol. May 1916; pp 203; pp 20; 60c.

Doheny, E. L.—*The Mexican Petroleum Co., Ltd.* [A description of the company, its development, operations, etc.].—Mg. & Oil Bull. May 1916; p 130; pp 5*; 25c.

Grady, W. H.—*Selecting and Buying Fuel.* [Charts, tables, description and discussion having to do with the selection of any class of fuel so as to get a minimum cost per ton. Heat value of the fuel and situation of the product with respect to the user are the main points].—Amer. Wood Preservers' Assn. 1916 Report; p 91; pp 14*; 35c.

Hadley, F. L.—*Welding Natural Gas Mains.* [A paper read before the Natural Gas Assn. Treats on the repair of both natural gas and steam mains].—Acetylene Jnl. June 1916; p 515; pp 2[illegible]; 20c.

Fuels Miscellaneous

Grady, W. H.—*Selecting and Buying Fuel.* [Charts, tables, description and discussion having to do with the selection of any class of fuel so as to get a minimum cost per ton. Heat value of the fuel and situation of the product [illegible] the main points].—Amer. Wood Preservers' Assn. [illegible]

Liddell, D. M.—*Metallurgists' and Chemists' Handbook.* [Contains data, prices, production, methods of assay, analysis, cyanidation, ore-dressing, and information on fuels, refractories, design and construction, etc.].—McGraw-Hill; book; pp 603*; $4.

——— *Powdered Coal Utilization at Lebanon, Pa.* [Waste-heat boilers are used in conjunction with open-hearth furnaces by the American Iron & Steel Mfg. Co. Details and drawings of their coal crushing plant are given].—Iron [illegible]

(C) OTHER NON-METALS

Asbestos

Diller, J. S.—*Asbestos in* 1915. [Deals with production and conditions of the trade].—Min. Res. U. S. II:4; pp 6.

Gems

Gregory, H. E.—*Garnet Deposits on the Navajo Reservation, Arizona and Utah.* [Geology, distribution and occurrence are the principal items of the article].—Eco. Geol. May 1916; p 223; pp 8*; 60c.

——— *Diamond Mining in Southwest Africa.*—S. Afr. Engg. April 1916; p 67; [illegible]

Magnesite

——— *Summary Report of the Geological Survey, Department of Mines, Canada,* 1915. [In one volume separate reports made during the year on different districts and topics are given].—Canadian Geol. Surv. Sessional Paper 26; [illegible]

Mica

[illegible]

Bitumens

Ball, L. C.—*Oil Shales and Coal at Sugarloaf, Queensland.* [The nature and quality of the materials are described].—Queen. Govt. Mg. Jnl. April 15 1916; [illegible]

Nitrates

Singewald, J. T., Jr.; Miller, B. L.—*The Genesis of the Chilean Nitrate Deposits.* [A paper read before the Pan-American Sci. Congress].—Eco. Geol. [illegible]

III. TECHNOLOGY

MINES AND MINING

Ore Reserves

Lupton, C. T.—*Geology and Coal Resources of Castle Valley in Carbon, Emery and Sevier Counties, Utah.* [The land is to be reopened to entries. Coal from 8,000 to 14,000 B. T. U. value is found. General geology of the formation and separate descriptions of the different seams are given].—U. S. G. S. [illegible]

Morgan, P. G.; Bartrum, J. A.—*The Geology and Mineral Resources of the* [illegible] Surv., Wellington; Bull. No. 17; pp 210; 75c.

Drilling and Boring

——— *Ford Collieries Co., New No. 3 Mine, Pennsylvania.* [After a general description of the surface equipment and power plant methods of cutting and haulage are taken up].—Elect. Mg. April 1916; p 33; pp 18*; 20c.

Explosives and Blasting

Storm, C. G.—*The Analysis of Permissible Explosives.* [Methods of quantitative analysis and methods of testing explosives are given. The classification and properties of the explosives are treated on some in conjunction therewith].—U. S. Bur. of Mines Bull. 96; pp 88*; 25c.

Tunnels and Tunneling

[illegible] *Works as Brought Out at the Wilson Ave. Tunnel, Chicago.* [A complete description of electric power used in the tunnel is given. Electricity is here used for hoisting, air compression, rock crushing, haulage, ventilation and lining the tunnel with concrete].—Elect. Rev. & West. Elect. June 3 1916; p 1017; pp 6¾*; 20c.

Ventilation

——— *Electric Power for Public Work as Brought Out at the Wilson Ave. Tunnel, Chicago.* [A complete description of electric power used in the tunnel is given. Electricity is here used for hoisting, air compression, rock crushing, haulage, ventilation and lining the tunnel with concrete].—Elect. Rev. & West. Elect. June 3 1916; p 1017; pp 6¾*; 20c.

Supports: Timbers, Props, Stowing

Cherrington, F. W.—*Creosoted Piling and Poles.* [Costs, description of methods and advantages obtained by the treatment are spoken of].—Amer. Wood Preservers' Assn. Report 1916; p 61; pp 9½* 35c.

Goss, O. P. M.—*Methods of Creosoting Douglas Fir Timbers.* [A brief detailed description of the methods, with tables showing the effects of such treatment].—Amer. Wood Preservers' Assn. 1916 Report; p 70; pp 15½*; 35c.

Goltra, W. F.—*Quantity of Zinc Chloride Per Tie or Per Cubic Foot of Timber and Method of Determining the True Strength of the Solution.*—Amer. Wood Preservers' Assn. 1916 Report; p 109; pp 8¼; 35c.

——— *Report of Committee on Specifications for the Purchase and Preservation of Treatable Timber.*—Amer. Wood Preservers' Assn. 1916 Report; p 171; [illegible]

Hoists and Hoisting

Yates, B. C.—*New Construction Work at the Homestake, South Dakota.* [A brief but detailed description of the new steam auxiliary electric station and skip hoist. The central steam plant, electric generating plant and hoist are included].—Pahasapa June 1916; p 31; pp 4; 30c.

——— [illegible] *as Brought Out at the Wilson Ave. Tunnel, Chicago.* [A complete description of electric power used in the tunnel is given. Electricity is here used for hoisting, air compression, rock crushing, haulage, ventilation and lining the tunnel with concrete].—Elect. Rev. & West. Elect. June 3 1916; p 1017; pp 6¾*; 20c.

Power Shovels and Excavators

Hirschberg, C. A.—*Subway Excavating Revolutionized.* [From the Mg. World. In some detail gives the methods of using

machine drills in this work].—Comp. Air May 1916; p 7971; pp 5*; 20c.

Mine Gas

Irvine, L. G.—*First-Aid Treatment of Cases of Gas Poisoning.* [Abst. from the Medical Jnl. of S. Afr.].—E. & M. J. May 20 1916; p 901; pp 1; 25c.

Haulage and Conveying

——— *Electric Power for Public Works as Brought Out at the Wilson Ave. Tunnel, Chicago.* [A complete description of electric power used in the tunnel is given. Electricity is here used for hoisting, air compression, rock crushing, haulage, ventilation and lining the tunnel with concrete].—Elect. Rev. & West Elect. June 3 1916; p 1017; pp 6½*; 20c.

——— *Ford Collieries Co., New Mine, Pennsylvania.* [After a general description of the surface equipment and power plant methods of cutting and haulage are taken up].—Elect. Mg. April 1916; p 33; pp 18*; 20c.

Sanitation

Hoffman, F. L.—*Miners' Nystagmus* (This is an eye disease. The symptoms, effects and causes are clearly defined, as also are methods of prevention, cure and treatment].—U. S. Bur. of Mines Bull. 93; pp 67; 20c.

———. *History of the Miners' Phthisis Problem on the Rand, South Africa.*—E. & M. J. May 27 1916; p 936; pp 1¼; 25c.

Labor and Management

Hoffman, F. L.—*Miners' Nystagmus* [This is an eye disease. The symptoms, effects and causes are clearly defined, as also are methods of prevention, cure and treatment].—U. S. Bur. of Mines Bull. 93; pp 67; 20c.

Irwin, E. F.—*Hiring, Handling and Firing.* [A general discussion and talk on the subject regarding labor, as seen by the manager of the employment department of the Homestake Mg. Co.].—Pahasapa June 1916; p 35; pp 4½*; 30c.

Schneider, Herman.—*Selecting Men for Jobs.* [Makes a thorough and detailed study of a man and his characters during the different periods of his life and points out features and characters which betray the nature and ability of the man].—Engg. Mag. June 1916; p 420; pp 12; 35c.

Production

Arnold, Ralph.—*Conservation of the Oil and Gas Resources of the Americas* [The occurrence and production from all the fields is discussed, with their reserves, so as to bring out the subject of conservation. Qualities of the various products are also given].—Eco. Geol. May 1916; pp 203; pp 20; 60c.

Diller, J. S.—*Asbestos in 1915.* [Deals with production and conditions of the [illegible] Rep. U. S. H. [illegible]; pp 6[illegible]

Liddell, D. M.—*Metallurgists' and Chemists' Handbook.* [Contains data, prices, production, methods of assay, analysis, cyanidation, ore-dressing, and information on fuels, refractories, design and construction, etc.].—McGraw-Hill; book; pp 603*; $4.

Morgan, P. G.; Bartrum, J. A.—*The Geology and Mineral Resources of the Buller Mineral Division, Westport Division, New Zealand.*—N. Z. Surv., Wellington; Bull. No. 17; pp 210*; 75c.

Rochert, W. C.—*Review of Mining Operations in the Northern Mills, South Dakota.* [The history and production of the gold, silver and tungsten properties of the state are reviewed in detail, though briefly.—Pahasapa June 1916; p 49; pp 5*; 30c.

Seaman, W. Y.—*The Lure of Cripple Creek Gold.* [A historic and current account of the gold deposits in this district. Production figures and descriptions of how many of the larger mines were discovered are given].—W. Y. Seaman, Denver; pp 48; 25c.

MILL AND MILLING

Sampling

Liddell, D. M.—*Metallurgists' and Chemists' Handbook.* [Contains data, prices, production, methods of assay, analysis, cyanidation, ore-dressing, and information on fuels, refractories, design and construction, etc.].—McGraw-Hill; book; pp 603*; $4.

Crushing, Grinding, Etc.

Willard, C. G.—*The Golden Reward Roaster, South Dakota.* [A brief description, with details on the crushing and roasting of the ores preliminary to cyanidation. Sulphur is reduced from an average of 6% to less than 1%].—Pahasapa June 1916; p 40; 6*; 30c.

——— *Electric Power for Public Works as Brought Out at the Wilson Ave. Tunnel, Chicago.* [A complete description of electric power used in the tunnel is given. Electricity is here used for hoisting, air compression, rock crushing, haulage, ventilation and lining the tunnel with concrete].—Elect. Rev. & West Elect. June 3 1916; p 1017; pp 6½*; 20c.

Flotation

Martin, A. H.—*The Flotation Process at Goldfield, Nevada.* [A concise detailed description of the plant equipment, operation and results obtained. Callow pneumatic flotation cells are used].—Mg. World June 3 1916; p 1041; pp 1¼; 10c.

Concentration: Sorting, Sizing, Washing

Liddell, D. M.—*Metallurgists' and Chemists' Handbook.* [Contains data, prices, production, methods of assay, analysis, cyanidation, ore-dressing, and information on fuels, refractories, design and construction, etc.].—McGraw-Hill; book; pp 603*; $4.

Cyaniding

Liddell, D. M.—*Metallurgists' and Chemists' Handbook.* [Contains data, prices, production, methods of assay, analysis, cyanidation, ore-dressing, and information on fuels, refractories, design and construction, etc.].—McGraw-Hill; book; pp 603*; $4.

Willard, C. G.—*The Golden Reward Roaster, South Dakota.* [A brief description with details on the crushing and roasting of the ores preliminary to cyanidation. Sulphur is reduced from an average of 6% to less than 1%].—Pahasapa June 1916; p 40; 6*; 30c.

CHEMISTRY AND ASSAYING

Chemistry

Barnitz, H. L.—*The Technical Production of Hydrogen and Its Industrial Application.* [Reprint from Met. & Chem. Engg. It is used to make the oxy-hydrogen flame for welding. Several different processes are described in general and some details given].—Barnitz, New York; pp 11; 30c.

Liddell, D. M.—*Metallurgists' and Chemists' Handbook.* [Contains data, prices, production, methods of assay, analysis, cyanidation, ore-dressing, and information on fuels, refractories, design and construction, etc.].—McGraw-Hill; book; pp 603*; $4.

Storm, C. G.—*The Analysis of Permissible Explosives.* [Methods of quantitative analysis and methods of testing explosives are given. The classification and properties of the explosives are treated on some in conjunction therewith].—U. S. Bur. of Mines Bull. 96; pp 88*; 25c.

Assaying

Liddell, D. M.—*Metallurgists' and Chemists' Handbook.* [Contains data, prices, production, methods of assay, analysis, cyanidation, ore-dressing, and information on fuels, refractories, design and construction, etc.].—McGraw-Hill; book; pp 603*; $4.

Analysis

Liddell, D. M.—*Metallurgists' and Chemists' Handbook.* [Contains data, prices, production, methods of assay, analysis, cyanidation, ore-dressing, and information on fuels, refractories, design and construction, etc.].—McGraw-Hill; book; pp 603*; $4.

Pratt, W. E.—*The Occurrence of Petroleum in the Philippines.* [Speaks of several occurrences of petroleum and describes the stratigraphy. Analyses of the oils are given].—Eco. Geol. May 1916; p 246; pp 20*; 60c.

Storm, C. G.—*The Analysis of Permissible Explosives.* [Methods of quantitative analysis and methods of testing explosives are given. The classification and properties of the explosives are treated on some in conjunction therewith].—U. S. Bur. of Mines Bull. 96; pp 88*; 25c.

METALLURGY

Thermic Metallurgy

Willard, C. G.—*The Golden Reward Roaster, South Dakota.* [A brief description with details on the crushing and roasting of the ores preliminary to cyanidation. Sulphur is reduced from an average of 6% to less than 1%].—Pahasapa June 1916; p 40; 6*; 30c.

Refractories

Liddell, D. M.—*Metallurgists' and Chemists' Handbook.* [Contains data, prices, production, methods of assay, analysis, cyanidation, ore-dressing, and information on fuels, refractories, design and construction, etc.].—McGraw-Hill; book; pp 603*; $4.

Metallurgy General

Liddell, D. M.—*Metallurgists' and Chemists' Handbook.* [Contains data, prices, production, methods of assay, analysis, cyanidation, ore-dressing, and information on fuels, refractories, design and construction, etc.].—McGraw-Hill; book; pp 603*; $4.

POWER AND MACHINERY

Electricity

Hay, T. R.—*How to Select Industrial Motors.* [Speaks of the correct type of motors for various classes of work].—Engg. Mag. June 1916; p 344; pp 11*; 35c.

Hays, J. W.—*Semi-Technical Studies in Physical Science.* [By description and tabulated data the costs of power for steam, gas and oil engine, electric power

plants varying from 20 to 500 kw., are compared. Costs for power in a 100-kw. plant with natural gas, illuminating gas and gasoline engines are also given].—Steam June 1916; p 157; pp 3¼; 35c.

Yates, B. C.—*New Construction Work at the Homestake, South Dakota.* [A brief but detailed description of the new steam auxiliary electric station and skip hoist. The central steam plant, electric generating plant and hoist are included].—Pahasapa June 1916; p 31; pp 1; 30c.

——— *Electric Power for Public Work as Brought Out at the Wilson Ave. Tunnel, Chicago.* [A complete description of electric power used in the tunnel is given. Electricity is here used for hoisting, air compression, rock crushing, haulage, ventilation and lining the tunnel with concrete].—Elect. Rev. & West. Elec June 3 1916; p 1017; pp 6¾; 20c.

——— *Ford Collieries Co., New No. 3 Mine, Pennsylvania* [After a general description of the surface equipment and power plant methods of cutting and haulage are taken up].—Elect. Mg. April 1916; p 33; pp 18*; 20c.

Compressed Air

——— *Electric Power for Public Works as Brought Out at the Wilson Ave. Tunnel, Chicago.* [A complete description of electric power used in the tunnel is given. Electricity is here used for hoisting, air compression, rock crushing, haulage, ventilation and lining the tunnel with concrete].—Elect. Rev. & West. Elect. June 3 1916; p 1017; pp 6¾*; 20c.

Gas Producers, Producer Gas

Spring, L. W.—*The Open Hearth Process.* [A talk on various methods employed in the process, with a practical talk on the theory of the same].—Valve World June 1916; p 197; pp 8¼*; 20c.

Combustion Engines

Hays, J. W.—*Semi-Technical Studies in Physical Science.* [By description and tabulated data the costs of power for steam, gas and oil engine, electric power plants varying from 20 to 500 kw., are compared. Costs for power in a 100-kw. plant with natural gas, illuminating gas and gasoline engines are also given].—Steam June 1916; p 157; pp 3¼; 35c.

Steam and Steam Engines

Hadley, F. L.—*Welding Natural Gas Mains.* [A paper read before the Natural Gas Assn. Treats on the repair of both natural gas and steam mains].—Acetylene Jnl. June 1916; p 515; pp 2½; 20c.

Hays, J. W.—*Semi-Technical Studies in Physical Science.* [By description and tabulated data the costs of power for steam, gas and oil engine, electric power plants varying from 20 to 500 kw., are compared. Costs for power in a 100-kw. plant with natural gas, illuminating gas and gasoline engines are also given].—Steam June 1916; p 157; pp 3¼; 35c.

Hubbard, C. L.—*How to Use Superheated Steam.* [The practical application of this kind of steam as the result of tests and investigation. Details are given].—Engg. Mag. June 1916; p 413; pp 7; 35c.

Moreland, F. V.—*"Soot" Its Composition, Its Effects on Boiler Efficiency, Its Removal by Mechanical Soot Cleaners.* [Reprinted from the Jnl. of the Ohio Soc. of Mech., Elect., & Steam Eng.]—Steam June 1916; p 160; pp 2; 35c.

Yates, B. C.—*New Construction Work at the Homestake, South Dakota.* [A brief but detailed description of the new steam auxiliary electric station and skip hoist. The central steam plant, electric generating plant and hoist are included].—Pahasapa June 1916; p 31; pp 1; 30c.

——— *Electric Power for Public Work as Brought Out at the Wilson Ave. Tunnel, Chicago.* [A complete description of electric power used in the tunnel is given. Electricity is here used for hoisting, air compression, rock crushing, haulage, ventilation and lining the tunnel with concrete].—Elect. Rev. & West. Elec June 3 1916; p 1017; pp 6¾; 20c.

——— *Ford Collieries Co., New No. 3 Mine, Pennsylvania.* [After a general description of the surface equipment and power plant methods of cutting and haulage are taken up].—Elect. Mg. April 1916; p 33; pp 18*; 20c.

——— *Powdered Coal Utilization at Lebanon, Pa.* [Waste-heat boilers are used in conjunction with open-hearth furnaces by the American Iron & Steel Mfg. Co. Details and drawings of their coal crushing plant are given].—Iron Age June 1 1916; p 1317; pp 2; 30c.

IV. MISCELLANEOUS

Miscellaneous Costs

Barnitz, H. L.—*The Technical Production of Hydrogen and Its Industrial Application.* [Reprint from Met. & Chem. Engg. It is used to make the oxy-hydrogen flame for welding. Several different processes are described in general and some details given].—Barnitz, New York; pp 11; 30c.

Cherrington, F. W.—*Creosoted Piling and Poles.* [Costs, descriptions of methods and advantages obtained by the treatment are spoken of].—Amer. Wood Preservers' Assn. 1916 Report; p 61; pp 9½*; 35c.

Grady, W. H.—*Selecting and Buying Fuel.* [Charts, tables, description and discussion having to do with the selection of any class of fuel so as to get a minimum cost per ton. Heat value of the fuel and situation of the product with respect to the user are the main points].—Amer. Wood Preservers' Assn. 1916 Report; p 91; pp 14*; 35c.

Hays, J. W.—*Semi-Technical Studies in Physical Science.* [By description and tabulated data the costs of power for steam, gas and oil engine, electric power plants varying from 20 to 500 kw., are compared. Costs for power in a 100-kw. plant with natural gas, illuminating gas and gasoline engines are also given].—Steam June 1916; p 157; pp 3¼; 35c.

Testing

Cone, E. F.—*Steel Castings and Pyhsical Properties.* [Gives results of static tests and shows that micrographs prove that these tests are not always to be relied on].—Iron Age June 1 1916; p 1310; pp 3; 30c.

Goltra, W. F.—*Quantity of Zinc Chloride Per Tie or Per Cubic Foot of Timber and Method of Determining the True Strength of the Solution.*—Amer. Wood Preservers' Assn. 1916 Report; p [illegible]

Hubbard, C. L.—*How to Use Superheated Steam.* [The practical application of this kind of steam as the result of tests and investigation. Details are given].—Engg. Mag. June 1916; p 413; pp 7; 35c.

Storm, C. G.—*The Analysis of Permissible Explosives.* [Methods of quantitative analysis and methods of testing explosives are given. The classification and properties of the explosives are treated on some in conjunction therewith].—[illegible] 1916; pp 88*; 25c.

Vreeland, G. W.—*Distribution of Raw* [illegible] [A paper read before the Amer. Iron & Steel Inst. The information is given as the result of many tests. Suggestions are also given regarding charging as it is related to the correct distribution of materials. Many of the test results are plotted on curves].—Iron Age June 1 1916; p 1332; pp 6*; 30c.

Metallography

Cone, E. F.—*Steel Castings and Pyhsical Properties.* [Gives results of static tests and shows that micrographs prove that these tests are not always to be relied on].—Iron Age June 1 1916; p 1310; pp 3; 30c.

Conservation

Arnold, Ralph.—*Conservation of the Oil and Gas Resources of the Americas.* [The occurrence and production from all the fields is discussed with their reserves so as to bring out the subject of conservation. Qualities of the various products are also given].—Eco. Geol. May 1916; p 203; pp 24; 30c.

Mitchell, W. G.—*An Experimental Wood-Preserving Laboratory.* [A general descrption of a plant for testing with some details of the equipment].—Wood-Preserving June 1916; p 33; pp 3*; 35c.

——— *Treating Ties for the G. R. & I., I. P. L. and P. M. Railroads.* [A brief description of the plants' equipment and a general description of their operations].—Wood-Preserving June 1916; p 27; pp 2¼*; 35c.

History

Blackstone, R.—*The Homestake Mine, South Dakota.* [Notes on the history of its development, discoverey and operation, including many of the prices paid for options and sales of claims which now make up the entire property].—Pahasapa June 1916; p 16; pp 15*; 30c.

Bochert, W. C.—*Review of Mining Operations in the Northern Hills, South Dakota.* [The history and production of the gold, silver and tungsten properties of the state are reviewed in detail, though briefly].—Pahasapa June 1916; p 40; pp 5*; 30c.

O'Hara, C. C.—*An Early Magazine Article on the Black Hills, South Dakota.* [For the greater part this is an abstract from an article by L. P. Richardson in Scribner's Monthly, April 1877. It describes his trip into the country about 1876].—Pahasapa June 1916; p 11; pp 5*; 30c.

Seaman, W. Y.—*The Lure of Cripple Creek Gold.* [A historic and current account of the gold deposits in this district. Production figures and descriptions of how many of the larger mines were discovered are given].—W. Y. Seaman, Denver; pp 48; 25c.

Societies

[illegible] nual meeting at London, England].—I. & C. Tr. Rev. May 5 1916; p 508; pp 5*; 35c.

——— *Iron and Steel Institute.* [An [illegible] May 1916; p [illegible]; 35

Financial

Blackstone, R.—*The Homestake Mine, South Dakota.* [Notes on the history of its development, discovery and operation, including many of the prices paid for options and sales of claims which now make up the entire property].—Pahasapa June 1916; p 16; pp 15*, 30c.

Ore and Metal Markets; Prices-Current

New York, June 15, 1916.

Silver—Quotations for silver per fine ounce at New York and per standard ounce at London for the week ending June 14 were as follows:

	New York Cents.	London. Pence.
June 8	66½	31⅝
9	62⅝	30
10	66¼	30¼
12	67	31
13	67½	30½
14	[illegible]	30⅛

MONTHLY AVERAGE PRICES OF SILVER.

Month.	New York 1916 High.	Low.	Avg.	1915. Avg.	London Standard Oz. 1916. Avg.	1915. Avg.
January	57⅝	55⅞	56.775	48.890	26.875	22.744
February	57	56½	56.755	48.177	27.000	22.759
March	64¼	56⅝	57.935	49.926	27.080	23.650
April	72½	60⅞	64.415	50.034	31.375	23.259
May	77¼	68¾	73	49.915	34.182	23.560
June	....	....	....	49.675	....	21.577
July		..		47.519	..	22.950
August		..		47.178		22.750
September				48.68		23.600
October		.		49.[illegible]	.	23.923
November				51.713		24.640
December	.			55.038		26.232
Year	..			49.600	.	23.470

Difference in domestic and foreign prices explained by the fact that the New York quotations are per fine ounce; the London per standard ounce 8.925 fine.

Copper—Demand for copper has almost been entirely absent. The large producers report a few sales, but their characterizations of the amount of business being done lack the zest and snap that prevailed in the last buying movement. From a broad viewpoint business has been very small. Second hands have not found consumers willing buyers of small lots of electrolytic for nearby delivery, while the producers are finding consumers opposed to buying for the fourth quarter so long as the peace rumors continue to prevail. The market is in a most unique position, prices being maintained, although the demand has been next to nothing in the past 4 weeks. Under ordinary circumstances the price of copper would have slumped or production considerably curtailed, but, with producers holding orders that will take fully 80% of the output this year, there is no need to stimulate buying. Second hands have been offering spot June and July electrolytic at 28 cts. and August and September at 27 cts., while the leading agencies quote the fourth quarter at 29 cts. Spot casting copper eased off to 26 cts., with sellers quoting 25¼ cts. for August and 25 cts. for September. It has been ascertained that the stocks of copper bought by Germans when the metal was selling around 14 cts., to be held until after the war, have been sold, the liquidation taking place when prices passed 22 cts. on wireless instructions from Germany. Thus a large amount of copper must be bought by the Germans for shipment as soon as peace is declared.

A change has been taking place in the volume of exports. Last week it was pointed out that exports did not jibe with the reported extent of foreign buying of copper. It is now apparent that shipments are increasing, and before long exports will soon create a new record mark. From June 1 to June 12 exports from New York, Philadelphia and Baltimore totaled 12,870 tons; so that the country's entire shipments in June may run close to 40,000 tons if the present rate is maintained. Some copper interests who were inclined to see a "nigger in the woodpile" in the small copper exports have now withdrawn their remarks. With production of copper amounting to fully 190,000,000 lbs. a month, it will require exports of 60,000,000 lbs. a month to fully absorb this output, as domestic consumption has reached its limit at 130,000,000 lbs. a month. Imports of copper have also been large, totaling 18,500 tons in April, as against 8700 tons in April, 1915.

The London market has been devoid of any sensational changes in the past week. There have been minor fluctuations in standard, while electrolytic has held unchanged at £142. The situation abroad with respect to limitation of trading has apparently worked out well, as the London operators are accepting the dictum of Lloyd George without protest.

Quotations for copper per pound at New York for the week ending June 14 were as follows:

(For Third Quarter Delivery.)

	Lake.	Electrolytic.	Casting.
June 8	28@28½	28@28½	26 @26¼
9	28@28½	28@28½	25½@26
10	28@28½	28@28½	25½@26
12	28@28½	28@28½	25 @25¼
13	28@28½	28@28½	25 @25¼
14	28@28½	28@28½	25 @25¼

Quotations for copper per ton at London for the week ending June 14 were as follows:

	Standard Spot.	Standard Futures.	Electrolytic.
June 8	£123 10 0	£119 0 0	£142 0 0
9	123 10 0	119 10 0	142 0 0
10	123 10 0	119 10 0	142 0 0
12	121 10 0	119 0 0	142 0 0
13	121 0 0	118 10 0	141 0 0
14	118 0 0	116 0 0	140 0 0

MONTHLY AVERAGE PRICES OF COPPER.

New York—Lake Superior.

Month	1916 High.	Low.	Average.	1915. Average.
January	25.50	23.00	24.101	13.891
February	28.50	25.25	27.437	14.72
March	28.25	27.25	27.641	15.11
April	30.00	28.50	29.40	17.398
May	29.75	28.25	29.05	18.812
June	.....		..	19.92
July	....			19.423
August	..			17.472
September	.			17.758
October	.			17.925
November	.			18.856
December	..			20.375
Year	.....			17.647

New York—Electrolytic.

Month.	1916 High.	Low.	Average.	1915. Average.
January	25.50	23.00	24.101	13.707
February	28.50	25.25	27.462	14.572
March	28.25	27.25	27.410	14.96
April	30.50	28.25	29.65	17.057
May	29.75	28.00	28.967	18.601
June	..		.	19.173
July				19.08
August	.			17.222
September				17.705
October				17.859
November				18.826
December				20.348
Year	.....			17.47

Quotations for electrolytic cathodes are 0.125 cent per lb. less than for cake, ingots and wire bars.

New York—Casting Copper.

Month	New York 1916 High.	Low.	Avg.	London 1916. Avg.	1915. Avg.
January	24.25	22.00	23.065	88.008	60.760
February	27.00	24.12½	26.031	102.760	63.392
March	27.75	25.50	26.240	106.185	66.235
April	28.00	26.75	27.70	103.681	77.461
May	27.75	26.00	26.692	104.794	77.360
June	....			.....	82.350
July	..			.	74.807
August	...			.	67.350
September	.				68.560
October					72.577
November					77.400
December					80.400
Year	..			..	.....

Tin—A fair amount of business was done last week in tin for arrival here in September, October and November, but buying on the whole was desultory, as sellers immediately seized upon the covering of forward needs as a basis to advance prices, thus putting an end to operations by consumers. The spot market has been heavy, due to the large arrivals since the first of the month, while the fact that England is allowing shipments to come forward freely tends to prevent any effort to bolster the market. Future positions, on the other hand, held firm, as there is still a good deal of buying to be done for delivery after September. Advances abroad

tended to stimulate this market last week, but a sharp break at the opening this week caused sellers to lower prices. Thus spot tin, after touching 45¼ cts. on June 8, receded to 44¼ cts. on Monday of this week. Spot Banka tin was offered as low as 42 cts. The extensive stock of Banka afloat also holds down the spot market. Arrivals of tin since the first of the month total 2425 tons, with 925 tons afloat on known steamers posted for June delivery. These arrivals, combined with stock and landing on June 1, naturally prohibit speculative activity.

Foreign markets advanced sharply last week. Straits tin at London went up £4 10s to £188 10s, while the Singapore market advanced £5 10s to £190 10s. At the opening this week Straits tin at London came £2 15s lower at £185 15s. Limits from Singapore for July shipment were offered at 41¼ cts., with Singapore asking 40@40¼ cts. for October and November arrival. The advance abroad indicates that the manipulators who were depressing market have completed their purchases. The English Government is not permitting much tin to go direct from the Straits to this country; so London operators are seeking to benefit by our greater dependence on exports from London and Liverpool.

Quotations for tin per pound at New York and per ton at London and Singapore for the week ending June 14 were as follows:

	New York Spot.	London. Straits spot	Singapore
June 8	45¼c	£188 0 0	£188 0 0
9	44½c	188 10 0	190 10 0
10	44½c	188 10 0	190 10 0
12	44¼c	185 15 0	190 0 0
13	43½c	182 10 0	186 0 0
14	43¼c	183 0 0	184 5 0

MONTHLY AVERAGE PRICES OF TIN, NEW YORK.

Month.	1916 High.	1916 Low.	1916 Average.	1915. Average.
January	45.00	40.87½	41.881	34.296
February	50.00	41.25	42.634	37.321
March	56.00	[illegible]	50.48	38.934
April	56.00	[illegible]	[illegible]	44.38
May	52.00	[illegible]	49.86½	38.871
June				40.373
July				37.498
August				34.386
September				33.13
October				33.077
November				39.375
December				38.755
Year				38.664

Lead—The market has been without support from either buyers and sellers in the past week, and as a result prices receded 30 points in the outside market, while the reduced price of the principal producer is only nominal at the best. Independents offered spot lead down to 6.85 cts. New York and 6.80 cts. St. Louis, although the A. S. & R. Co. set its price at 7 cts. New York and 6.92½ cts. St. Louis. Speculators were offering lead for September delivery at 6.70 cts. New York, with August delivery quoted at 6.75 cts. New York, and July at 6.80 cts. New York. The declines caused consumers to put off buying, it having been ascertained that some fair-sized inquiries were in the market, but were withdrawn when the concessions were made. The situation is approaching a stage where the leading interest may be compelled to announce another reduction during the last 10 days of the month, as the spread in prices is too much to allow the holding of the 7-ct. figure over the month. Few munition contracts involving lead are being placed in this country, and it is now felt that lead production is in excess of consumption. The producers, however, declare that should the war continue beyond September it would mean another winter campaign, and new and large rifle cartridge contracts would be placed; so that the present rate of output may eventually find a market. At London lead prices have fluctuated sharply, spot closing the week 5s lower at £31 15s and futures 2s 6d lower at £31 5s.

Quotations for lead per pound at New York and per ton at London for the week ending June 14 were as follows:

	New York Indpts.	New York A. S. & R. Co.	Spot.	Futures
June 8	6.90c	7.00c		
9	6.85c	7.00c	31 15	31 5
10	6.85c	7.00c	31 15	31 5
12	6.85c	7.00c		
13	6.80c	7.00c		
14	6.87½c	7.00c		

MONTHLY AVERAGE PRICES OF LEAD.

Month.	New York 1916 High.	New York 1916 Low.	New York 1916 Average.	New York 1915. Avg.	London 1916. Avg.	London 1915. Avg.
January	6.20	5.50	5.926	5.730	31.92	18.637
February	6.55	6.10	6.271	3.350	33.108	19.804
March	8.00	6.50	[illegible]	4.066	34.410	22.010
April	8.00	[illegible]	[illegible]	[illegible]	33.70	21.100
May	7.50	[illegible]	[illegible]	4.235	33.209	20.120
June				5.875		25.750
July				5.738		25.611
August				4.750		22.150
September				4.627		22.953
October				4.612		23.932
November				5.152		[illegible]
December				5.346		[illegible]
Year				4.675		23.099

Lead Ore.—In the Missouri-Kansas-Oklahoma district the market still was weak. During the first part of the week ended June 10 the prices remained as during the previous week at $82 and $80 but about the middle of week these were cut to $80 and $78. Production of concentrate during the week was increased to 1,900,000 lbs. and this made the total for the year to date 50,085,422 lbs. and the respective values given these two productions are $77,745 and $2,264,005.

MONTHLY AVERAGE PRICES OF JOPLIN LEAD ORE.

Month.	1916 High.	1916 Low.	1916 Average.	1915. Average.
January	81.00	70.00	73.15	47.00
February	90.00	83.00	86.45	47.00
March	100.00	87.00	93.50	48.70
April	118.00	94.40	106.20	50.50
May	97.00	92.00	94.75	50.50
June				63.50
July				59.00
August				47.50
September				48.25
October				51.80
November				63.00
December				71.375
Year				53.44

Zinc Ore.—The hoistermens' strike in the Missouri-Kansas-Oklahoma district probably had something to do with the slightly better market. There was considerable more demand for second grades than during the previous week and the price advanced from $65 to $70 while the better grades still brought $90. During the week ended June 10 there were produced 12,696,900 lbs. of concentrates and the total for the year was 323,353,684 lbs. These quantities were respectively valued at $492,291 and $15,843,582.

Calamine remained about the same as during the previous week and most ores brought from $50 to $60. There were produced 258,870 lbs. of concentrates bringing the total of the year to date at 18,226,920. The production for the week was increased nearly 100% with respect to the previous week. Values of the production for the week and year to June 10 were $7,164 and $684,588.

MONTHLY AVERAGE PRICES OF JOPLIN ZINC ORE.

Month.	1916 High.	1916 Low.	1916 Average.	1915. Average.
January	120.00	85.00	106.25	53.90
February	120.00	86.00	111.75	63.125
March	115.00	80.00	100.50	62.50
April	100.00	98.00	99.25	61.25
May	115.00	60.00	88.125	69.60
June				116.00
July				111.00
August				60.25
September				76.75
October				82.40
November				92.50
December				87.00
Year				102.95

Spelter—Efforts to capitalize the labor troubles in the Joplin district failed of success, as buyers quickly ascertained that the strike would prove to be a fiasco. For a time there was some buying of a protective nature, but business on the whole did not savor of a general resumption in demand. Sellers, however, have endeavored to hold prices at the recent advance, but latterly there has been some price shading evident. Spot spelter advanced to 13⅝ cts. New York and 13⅜ cts. St. Louis, with a little busines done around these figures. At the opening of the current week sellers offered spot at 13½ cts. New York and 13¼ cts. St. Louis.

Consumers are not the least interested in future positions, and quotations are nominal at 13 cts. for June delivery St. Louis, 12½ cts. for July delivery, and 12@12¼ cts. for August delivery. At times in the past week the London market has been above our parity, but the cabled offers here did not equal the prices quoted on this side. London advanced

sharply last week up to Thursday, but had a sudden break on Friday, which almost completely wiped out the gains.

Quotations for spelter per pound at New York and per ton at London for the week ending June 14 were as follows:

	New York Spot	London Spot	London Futures
June 8	13⅝c	£61 0 0	£63 0 0
9	13⅝c	61 0 0	61 0 0
10	13⅝c	61 0 0	61 0 0
12	13½c	61 0 0	61 0 0
13	13½c	60 0 0	60 0 0
14	13.90c	60 0 0	60 0 0

MONTHLY AVERAGE PRICES OF SPELTER

Month	New York 1916 High.	1916 Low.	1916 Avg.	New York 1915. Avg.	London 1916. Avg.	London 1915. Avg.
January	19.42½	17.30	18.801	[illegible]	89.846	39.819
February	21.17½	18.67½	20.094	8.865	97.840	39.437
March	20.50	16.50	18.40	10.125	100.720	44.278
April	19.53½	17.75	18.76	11.48	98.103	48.942
May	19.00	13.75	15.98	15.825	89.507	67.320
June				22.625		100.320
July				20.803		98.150
August				16.110		68.250
September				14.493		64.400
October				14.196		64.196
November				16.875		88.240
December				16.675		89.153
Year				13.944*		66.979

*For the first nine months; spot market nominal thereafter.

MISCELLANEOUS METALS.

Quicksilver—Further recession in quicksilver has developed, prices declining $6 a flask since our last report to $68 per flask of 75 lbs., at which figure sellers are offering and would probably accept a shade under. The market is very weak, and imports from Mexico as well as Europe tend to prevent any effort to restore former conditions.

Antimony—Absolute dullness prevails in antimony with the market weak. Sellers are asking 21½ cts. for good brands of spot metal, this price being 3 cts. under that quoted a week ago. The market has no support, and sellers indicate that they would accept firm offers under 21 cts. for spot, while future deliveries are unsalable.

Aluminum—The market has strengthened on a good demand, spot No. 1 Virgin ingots selling at 60@62 cts. per pound in ton lots. A good business has been done in the past week in spot, but little has developed in futures. The leading interest is still quoting 35 cts. for 1917 delivery.

Platinum—There has been an easing up in prices on platinum, sellers quoting $75 an ounce for refined metal.

Nickel—There has been no change in the situation. Demand continues fair, while sellers are still quoting 45@50 cts. for ordinary forms, and the usual 5 cts. extra for electrolytic.

Finished Copper, Brass and Other Products—Zinc sheet makers have again lowered prices, now asking 21 cts. There has been an advance of $5 in prompt aluminum sheets, which have gone up to $75@95. Lead sheets are weak, but old prices are contained, although it is expected that makers will soon announce another reduction. The following prices are all f. o. b. mill:

Sheet zinc	$24.00@
Sheet aluminum, 1917 contract	10.00@
Sheet aluminum, outside market, prompt shipment	75.00@95.00
Copper tube	32.00@33.00
Sheet copper, hot rolled	37.50@.....
Sheet copper, cold rolled	38.50@
Brass sheet, will [illegible] and tools	38.00@39.00
Brass sheet, white and tools	29.50@12.00
Brass rods and tubes	10.00@12.00
Brass wire	10.00@
Lead sheet	9.25@
Lead pipe	8.50@

Pig Iron—Foreign demand has been the main sustaining factor in pig iron. Italy and France being in the market for extensive amounts of Bessemer, while Japan is seeking tonnages of low phosphorus. Domestic demand for foundry grades has been poor, and as a result speculators at Birmingham holding resale iron have offered at concessions, sales being made as low as $14.50 Birmingham, although the southern furnaces are asking $15. Prices in other districts are unchanged and steady. Two large eastern consumers, the American Locomotive Co. and the American Brake Shoe & Foundry Co., are now in the market for foundry grades. Production of pig iron in May reached a new record mark, 3,351,073 tons, or 108,099 tons a day.

Ferromanganese and Other Alloys—Easier conditions are noted in ferromanganese, domestic competition causing a general weakness in second half deliveries. It is noteworthy to report that production of ferromanganese and speigeleisen in this country in May amounted to 35,844 tons, whereas the average monthly output in 1915 was only 19,570 tons. Domestic makers are offering 80% or equivalent at $225@250 furnace for July delivery. Consumers are not disposed to buy far ahead. In speigeleisen there has been some good-sized foreign and domestic business done. Speigeleisen for the second half has eased off to $50 furnace.

PRICES-CURRENT.

Acids—Muriatic 18 deg.	3.00	to	3.25
Muriatic, 20 deg.	3.25	to	3.50
Nitric, 36 deg.	.07⅝	to	.08
Nitric, 40 deg.	.08½	to	.08¾
Alcohol—U. S. P., gal. grain	2.70	to	2.72
Denatured 188 proof, gal.	2.68	to	2.70
Wood, 97 p. c.	.70	to	.71
Alum—Powdered, lb.	.05¼	to	.08
Ground, lbs.	.041	to	.07½
Lump, lb.	.04	to	.06½
Ammonia -			
Muriate, white grain, lb.	.08¾	to	.08⅞
Muriate, lump	.17	to	.18
Arsenic—White, lb.	.06¼	to	.06⅝
Red, lb.	.65	to	.70
Barium Chloride—Ton	110.00	to	115.00
Nitrate, kegs, lb.	.18	to	.19
Bismuth—Metallic, lb.	3.11	to	3.20
Subnitrate	3.10	to	3.15
Bleaching Powder			
Drums, 100 lbs.	5.25	to	5.75
Borax—100 lbs., car lots	7.50	to	8.00
Coke—Connellsville furnace	2.50	to	2.75
Foundry	3.00	to	3.50
Copperas—Spot, lb.	1.50	to	2.00
Ferromanganese—Spot	250.00	to	350.00
Last half	200.00	to	225.00
Ferrosilicon, 50%			85.00
Ferrotitanium, per lb.	.08	to	.12½
Fuller's Earth, 100 lbs.	.80	to	1.05
Glaubers Salts, bags	.60	to	.70
Calcined			2.50
Iron Ore -			
Bessemer, old range, ton			4.45
Bessemer, Mesabi			4.20
Non-Bessemer, old range			3.70
Non-Bessemer, Mesabi			3.55
Lead—Granulated, lb.	.15	to	.15¾
Brown sugar	.13¾	to	.14
White crystals	.15⅝	to	.15⅞
Broken, cakes	.14⅞	to	.15
Powdered	.17	to	.17½
Litharge, American, lb.	.09	to	.09½
Mineral Lubricants			
Black summer	.13	to	.14
20 gr., 25 c. t.	.14	to	.15
Cylinder, light, filtered, gal.	.21	to	.26
Neutral, filtered, lemon, 20 gr.	.37½	to	.38
Wood grade, 30 gr.	.19½	to	.20
Paraffin—High viscosity	.29½	to	.30
Naphtha (New York)—			
Gasoline, auto	.32¾	to	.33¼
Benzine, 59 to 62°, gal.	.29	to	.29½
Nickel Salt, double	.07½	to	.08½
Single	.10½	to	.11
Petroleum			
Crude (jobbing), gal.	.15	to	.18
Refined, bbl			.12
Platinum—Oz. ref.	80.00	to	86.00
Potash Fertilizer Salts—			
Kainit, min. 16% actual potash			32.00
Muriate, 80 to 85%, basis 80%, ton	450.00	to	475.00
High grade sulphate, 90 to 95%, basis of 90%	400.00	to	450.00
Hard salt, man., 12.4% actual potash	Nominal		32.00
Potassium—			
Bichromate	.51	to	.52
Carbonate, cal. 96 to 98%	1.55	to	1.57
Cyanide, bulk, per 100%	.75	to	1.00
Chlorate	.58	to	.60
Prussiate, yellow	1.35	to	1.40
Prussiate, red	4.50	to	4.75
Saltpeter—Crude, lb.	.09½	to	.10
Refined	.35	to	.36½
Soda—Ash, 58% (43% basis), bbl.	1.25	to	1.50
Strontia Nitrate, casks, lb.	.45	to	.46
Sulphur—			
Crude, ton	28.50	to	29.00
Flowers, 100 lbs.	2.50	to	2.70
Roll, 100 lbs.	1.95	to	2.25
Tin—Bichloride, 50°, 100 lbs.	17.25	to	17.75
Crystals, bbls., lb.	.33	to	.33½
Oxide, lb	.51	to	.53
Zinc Chloride	.15	to	.22

Dividends of United States Mines and Works

Gold, Silver, Copper, Lead, Nickel, Quicksilver, and Zinc Companies.

NAME OF COMPANY		Number Shares Issued	Par Val	Dividends on Issued Capitalization: Paid in 1916	Total to date	Latest: Date	Amt.
Acacia, g....	Colo ..	1,438,989	$1	$......	$136,194	Dec. 25,'12	$0.01
Adams, s l c....	Colo ..	80,000	10	......	778,000	Dec. 18,'09	.04
Ahmeek c....	Mich..	200,000	25	1,100,000	4,655,000	Apr. 10,'16	3.00
Alaska Goldfields....	Alaska	250,000	5	......	403,250	Jan. 10,'15	.15
Alaska Mexican, g..	Alaska	180,000	5	......	3,507,381	Nov,28,'15	.10
Alaska Mines Sec....	U. S...	500,000	5	......	90,000	Nov. 1,'06	......
Alaska Treadwell, g	Alaska	200,000	25	250,000	15,780,000	May 29,'16	.50
Alaska United, g....	Alaska	180,200	5	54,060	2,045,270	Feb. 28,'16	.30
Allouez....	Mich..	100,000	25	250,000	350,000	Apr. 10,'16	1.50
Amalgamated, c....	Mont .	1,538,829	100	......	103,444,983	Aug. 30,'15	3.77
Am. Sm. & R., com	U. S...	500,000	100	500,000	29,833,333	Mar. 1, '16	1.00
Am. Sm. & R., pf..	U. S...	500,000	100	875,000	55,671,386	Mar. 1, '16	1.75
Am. Sm. Sec. A pf..	U. S...	170,000	100	510,000	11,210,000	Apr. 1, '16	1.50
Am. Sm. Sec. B pf..	U. S...	300,000	100	750,000	16,260,000	Apr. 3, '16	1.25
Am. Zinc, L. & Sm	Mo....	83,220	25	......	1,108,820	Apr. 10,'13	.50
Anaconda, c....	Mont..	2,331,250	50	6,993,750	171,851,771	May 20,'16	1.50
Annie Laurie, g....	Utah..	25,000	100	......	439,561	Apr. 22,'05	.50
Argonaut, g....	Cal.. ..	200,000	5	15,000	1,635,000	Mar.25, '15	.07½
Arizona, c....	Ariz...	......	...	629,550	20,220,434	Apr. 1, '16	.30
Atlantic, c....	Mich..	100,000	25	......	990,000	Feb. 21.'05	.50
Bagdad-Chase, g. pf.	Cal.. ..	84,819	5	......	202,394	Jan. 1,'09	.10
Bald Butte ,g. s....	Mont..	250,000	1	......	1,354,648	Nov. 1, '07	.04
Baltic, c....	Mich..	100,000	25	......	7,950,000	Dec. 31, '13	2.00
Beck Tunnel Con....	Utah..	1,000,000	0.10	......	940,000	Nov. 15,'07	.02
Big Four Expl.	Utah..	500,000	1	20,000	20,000	May 15,'16	.05
Bingham-N. Haven	Utah..	228,689	5	......	960,493	Dec. 20,'15	.20
Board of Trade, z....	Wis. ..	120,000	1	......	78,000	Jan. 16,'11	.05
Bonanza Dev	Colo .	300,000	1	......	1,425,000	Oct. 28, '11	.20
Booth (Reorganized	Nev...	999,395	5	299,871	299,871	Apr. 26,'16	10
Boss, g....	Nev..	408,500	1	......	40,850	Dec. 10,'14	.10
Boston & Colo. Sm..	Colo ..	15,000	10	......	402,350	Oct.....'02	.75
Bost. & Mont. Con.	Mont..	100,000	25	......	63,225,000	May 15, '11	4.00
Breece, l. s....	Colo ..	200,000	25	......	220,000	Dec. 15,'13	.10
Brunswick Con., g..	Cal. ...	300,000	1	......	203,315	Sept.15,'15	.06
Bullion-B & Champ	Utah..	100,000	10	......	2,768,400	July 11,'08	.10
Bullwhacker, c....	Mont..	450,000	1	......	10,000	July 1, '07	.01
Bunker Hill Con. g.	Cal. ...	200,000	1	25,000	846,000	May 4, '16	.02½
Bunker Hill & Sull.	Idaho.	327,000	10	664,000	17,427,000	May 4, '16	.40
Butte Alex Scott....	Mont..	75,000	10	11,897	221,354	Jan. 10,'16	.15
Butte-Ballaklava, c.	Mont..	250,000	10	......	125,000	Aug. 1, '10	.50
Butte Coalition, c....	Mont..	1,000,000	15	......	4,700,000	Dec. 1, '11	.25
Butte & Superior, z.	Mont..	272,672	10	2,931,224	8,451,169	Mar. 31,'16	10.75
Caledonia, l. s. c....	Idaho.	2,605,000	1	364,700	1,247,431	May 5, '16	.03
Calumet & Ariz., c..	Ariz...	617,412	10	1,334,824	24,483,049	Mar. 20,'16	2.00
Calumet & Hecla, c.	Mich..	100,000	25	1,500,000	130,750,000	Mar. ,23'16	15.00
Calvert, z....	Wis. ..	78,672	1	......	3,933	Dec. 20, '10	.05
Camp Bird, g....	Colo ..	1,750,000	25	113,584	10,243,964	Jan. 1, '16	.17½
Cardiff,s, l....	Utah..	500,000	1	......	125,000	Oct. 1, '15	.25
Carisa, g. s. c....	Utah..	600,000	1	......	60,000	Dec.... '06	.01
Cashier, g....	Colo ..	900,000	1	......	26,160	Apr. ...'04	.00⅛
Centennial Eureka.	Utah..	100,000	25	100,000	4,000,000	Apr. 25,'16	1.00
Center Creek, l. z....	Mo. ...	100,000	10	55,000	635,000	May 1, '16	.25
Central Eureka, g....	Cal. ...	100,000	1	......	799,159	Mar 5. '06	.05
Century, g. s. l....	Utah..	1,000,000	1	44,000	392,087	Feb. 15,'16	.05
Champion, c....	Mich..	100,000	25	2,080,000	13,080,000	May 7, '16	6.40
Chief Con....	Utah .	877,046	1	87,704	438,565	May 7, 16	.05
Chino Copper c....	N. M..	869,980	5	1,087,475	7,785,470	Mar. 31,'16	1.00
C. K. & N. g....	Colo ..	1,431,900	1	......	171,828	Nov. .. '04	.01
Cliff, g....	Alaska	100,000	1	......	115,000	Feb. 5, '14	.05
Cliff. s. l....	Utah..	300,000	10	......	90,000	Jan. 1, '13	.10
Clinton, g. s....	Colo ..	1,000	100	......	60,000	Dec. ...'03	.30
Colo. G. Dredging..	Colo ..	200,000	10	200,000	875,000	Feb. 23,'16	1.00
Colorado, s. l....	Utah..	1,000,000	0.20	......	2,600,000	Mar. 15,'13	.03
Columbus Con.,l.s.c.	Utah..	283,540	5	......	212,623	Oct. 14 '07	.20
Combination, g.	Nev...	320,000	1	......	873,000	Dec.... '06	.15
Comstock-Phoenix.	Nev...	785,000	1	......	50,000	Nov.15,'11	.05
Con. Mercur, g....	Utah..	1,000,000	1	......	1,265,000	June25,'13	.03
Consolidated, g....	Colo ..	2,500,000	1	......	380,000	Mar.... '02	.01
Con. St. Gothard, g.	Cal. ...	100,000	10	......	11,430	Oct. 14, '08	.05
Continental, z....	Mo. ...	22,000	25	......	561,000	Dec. 30,'15	10.00
Copper Range Co., c	Mich..	394,001	100	591,101	15,759,950	Mar. 15,'16	1.50
Creede United, g....	Colo ..	500,000	1	......	187,500	July....'06	.00½
Cripple Creek, g. pf.	Colo ..	125,000	1	......	45,000	Jan. ... '02	.04
Cripple Ck. Con. g..	Colo ..	2,000,000	1	......	180,000	Mar.... '04	.00½
Croesus, g....	Cal. ...	200,000	5	......	247,300	May 2, '08	.05
Crown King....	Ariz...	400,000	10	......	242,760	May ...'01	.02
Cumberland-Ely, c.	Nev...	1,300,000	5	......	390,000	Sept.29,'10	.10
Dall, z. l....	Wis....	60,000	1	......	33,000	Nov. 25 '09	.05
Dalton & Lark,l.s.c.	Utah..	2,500,000	1	......	350,000	July....'01	.10½
Daly-Judge....	Utah..	300,000	1	75,000	1,230,000	Apr. 1, '16	.25
Daly, g. s. l....	Utah..	150,000	20	......	2,925,000	Mar.... '97	.25
Daly-West, g. s.l....	Utah..	180,000	20	......	6,606,000	Jan. 15,'13	.15
De Lamar, g. s....	Idaho.	80,000	5	......	2,777,520	Aug. 23,'11	.25
Diamondfield, g....	Nev...	732,000	1	......	14,650	Sept. .. '05	.02
Dillon, g....	Colo ..	1,250,000	1	......	156,250	Nov. .. '05	.01
Dr. Jack Pot Con....	Colo ..	3,000,000	0.02½	......	90,000	Mar.20, '11	.00½
Doe Run, l....	Mo....	65,785	100	......	3,156,309	Dec. 6, '13	.76
Ducktown, c....	Tenn..	973,300	5	......	1,600,000	May 1, '12	.25
Duluth & Utah....	Utah..	50,000	20	......	10,000	Mar. 10,'15	.04
Eagle & Blue Bell..	Utah..	893,146	1	......	447,600	Dec. 20,'15	.05
Elkton Con., g....	Colo ..	2,500,000	1	100,000	3,647,460	May 19,'16	.02
El Paso, g....	Colo ..	490,000	5	......	1,707,545	Feb. 25,'14	.10
Ernestine, g. s....	N. M..	300,000	5	......	565,000	July 5, '15	15
Federal Sm. com....	Idaho.	60,000	100	......	2,708,750	Jan. 14,'09	1.50
Federal Sm., pf....	Idaho.	120,000	100	[illegible]	12,095,552	May 22 '16	1.00
Findley, g....	Colo ..	1,250,000	1	......	350,000	Sept. .. '06	.01
Florence Annex....	Nev...	1,000,000	1	......	50,000	Jan. 20, '08	.05
Florence (Goldfie'd)	Nev...	1,050,000	1	......	840,000	Apr. 2, '11	.10
Frances Mohawk, g.	Nev...	910,000	1	......	541,000	Jan. 1, '08	.06
Franklin....	Mich..	166,318	25	......	2,238,148	Aug. 2, '15	6.00
Fremont Con., g....	Cal. ...	200,000	2.50	......	264,000	Dec. 1, '15	.05
Free Coinage, g....	Colo ..	10,000	100	......	180,000	Dec. 25, '09	1.00
Frontier, z....	Wis....	1,239	100	......	[illegible]	Dec. [illegible]	2.00
Gemini-Keystone, l.	Utah..	5,000	100	[illegible]	[illegible]	Mar.15,'16	5.00
General Dev. Co....	N. Y..	120,000	25	[illegible]	3,143,922	Mar. 1, '16	1.25
Glanville, z....	Wis....	2,800	25	......	15,400	June 4, '09	1.00
Golconda....	Ariz...	850,000	1	......	170,000	Dec. 16,'15	.10
Gold Chain g....	Utah..	100,000	25	......	160,000	May 25,'13	.03
Gold Coin of Victor.	Colo ..	1,000,000	1	......	1,350,000	Feb.14, '09	.02
Gold Dollar Con., g.	Colo ..	2,500,000	1	......	100,000	Dec. 1, '12	.00½
Gold King Con., g..	Colo ..	5,750,370	1	......	1,351,808	Nov. 1,'15	.01
Gold Roads....	Ariz...	300,000	10	......	150,000	Nov. .. '06	[illegible]
Gold Sovereign....	Colo...	1,800,000	1	......	31,571	Nov.14,'12	.00½
Golden Centre, g....	Cal. ...	275,000	1	22,000	33,000	Apr. 1, '16	.04
Golden Cycle, g....	Colo ..	1,500,000	1	[illegible]	7,698,300	May 10,'16	.02

Corrected to June 1, 1916

NAME OF COMPANY		Number Shares Issued	Par Val	Dividends on Issued Capitalization: Paid in 1916	Total to Date	Latest: Date	Amt
Golden Eagle, g....	Colo ..	480,915	$1	$......	$98,916	Sept. .. '01	$0.01
Golden Star, g....	Ariz...	400,000	5	......	120,000	Mar.15, '10	.06
Gol'd Com. Fra., g..	Nev...	922,000	1	......	92,111	Oct. 15, '09	.10
Goldfield Con....	Nev...	3,559,148	10	......	28,999,831	Oct. 31, '15	.10
Good Hope, g. s....	Colo...	500	100	......	941,250	Jan..... '03	.25
Grand Central, g....	Utah .	500,000	1	......	1,545,200	Dec. 23, '15	.02½
Grand Gulch, c. s....	Nev...	239,845	2.50	2,400	9,595	Mar. 1, '16	.01
Granite, g....	Alaska	430,000	1	8,600	8,600	Apr.10, '16	.02
Gwin, g....	Cal. ...	100,000	10	......	481,500	Feb.... '06	.25
Hazel, g....	Cal. ...	900,000	1	......	1,114,000	Jan. 5, '15	.01
Hecla, s. l....	Idaho	1,000,000	0.25	500,000	4,255,000	May 20, '16	.10
Hercules....	Idaho	1,000,000	1	1,250,000	12,000,000	May 16, '16	.30
Hidden Treasure, g.	Cal. ...	30,000	10	......	457,452	Sept. .. '00	.10
Holy Terror, g....	S. D...	500,000	1	......	172,000	Jan..... '00	.01
Homestake, g....	S. D...	251,160	100	716,370	41,274,322	May 25, '16	.65
Hope Dev....	Cal. ...	500,000	1	......	5,000	Dec. 31, '15	.01
Horn Silver, l. s. z....	Utah .	400,000	1	20,000	5,682,000	Feb. 5, '16	.05
Imperial, c....	Ariz...	500,000	10	......	300,000	June 24 '07	.20
Independ'ce Con., g	Colo...	2,500,000	1	......	281,375	Apr. ... '01	.04
Inspiration Con....	Ariz..	920,687	20	1,149,859	1,149,859	May 1, '16	1.25
Inter'l Nickel, com.	U. S...	380,315	100	1,901,576	23,601,266	Mar. 1, '16	5.00
Inter'l Nickel, pf....	U. S...	89,126	100	267,378	5,614,824	May 1, '16	1.50
Intern'l Sm. & Ref.	U. S...	100,000	100	....	4,100,000	May 2, '14	2.00
Interstate-Callahan	Idaho	460,000	10	690,000	3,220,000	Mar. 31,'16	1.50
Iowa, g. s. l....	Colo...	1,666,667	1	......	270,167	Dec. 31,'15	.00½
Iowa Tiger, g. s. l....	Colo...	3,000	1	......	25,179	Jan. 15,'15	.50
Iron Blossom, l. s. g.	Utah ..	1,000,000	1	150,000	2,650,000	Apr. 15,'16	.10
Iron Cap pfd. c....	Ariz...	33,481	10	......	23,381	Dec. 31,'15	.17½
Iron Clad, g....	Colo...	1,000,000	1	......	50,000	Nov. .. '06	.05
Iron Silver....	Colo...	500,000	20	......	5,050,000	Dec. 31,'15	.10
Isabella, g....	Colo...	2,250,000	1	......	742,500	Mar.... '01	.01
Isle Royale, c....	Mich..	150,000	25	......	150,000	Mar.31,'13	1.00
Jamison, g....	Cal. ...	390,000	10	......	378,300	Jan.....'11	.02
Jerry Johnson, g....	Colo...	2,500,000	0.10	......	187,500	Nov. 5,'14	.00½
Jim Butler....	Nev...	1,718,021	0.10	17,180	188,982	Feb. 2,'16	.01
Joplin Ore & Spelter	Mo....	400,000	1	22,004	22,004	May 1, '16	.05½
Jumbo Ext., g....	Nev...	1,550,000	1	116,250	609,615	Mar. 31, 16	.07½
Kendall, g....	Mont	500,000	5	50,000	1,555,000	Apr. 3, '16	.10
Kenefick Zinc....	Mo....	200,000	...	40,000	40,000	Apr. 29,'16	.10
Kennecott....	Alas..	250,000	10	2,800,000	7,800,000	Mar. 31,'16	1.00
Kennedy, g....	Cal. ...	100,000	100	......	1,801,001	June... '00	.05
King of Arizona, g..	Ariz...	200,000	1	......	396,000	Aug. 2, '09	.12
Klar Piquett, z....	Wis. ..	20,000	1	......	157,500	Dec. 16,'12	.25
Knob Hill, g....	Wash .	1,000,000	1	......	70,000	Aug. 1,'13	.00½
La Fortuna, g....	Ariz...	250,000	1	......	1,200,500	Oct..... '02	.01½
Lake View....	Utah..	500,000	1	56,250	102,500	May 10,'16	.02¼
Last Dollar, g....	Colo...	1,500,000	1	......	180,000	Feb. 23, '03	.02
Liberty Bell, g....	Colo...	130,551	5	......	1,752,795	Jan. 31,'16	.05
Lightner, g....	Cal. ...	102,255	1	......	331,179	June... '06	.05
Linden, z....	Wis. ..	1,020	10	......	11,200	Dec. 31,'15	3.00
Little Bell, s. l....	Utah .	300,000	1	......	60,000	Sept.22,'10	.05
Little Florence....	Nev...	1,000,000	1	......	430,000	Jan.....'08	.03
Lost Packer....	Idaho.	150,000	1	......	37,500	Oct. 23,'13	.25
Lower Mammoth....	Utah ..	1,000,000	1	......	67,000	Dec. 15,'15	.01
Lucky Budge, z....	Mo.. ..	400	100	......	46,800	Apr. 23, '06	12.00
MacNamara, g. s....	Nev...	734,576	1	......	40,399	May 2, '10	.02
Magma, c....	Ariz...	240 000	5.00	120,000	360,000	Mar. 31,'16	.50
Mammoth, g. s. c....	Utah ..	400,000	.10	40,000	2,360,000	Apr. 20,'16	.05
Manhattan-Big 4, g.	Nev...	762,400	1	......	30,248	Aug. 15,'11	.02
Mary McKinney, g.	Colo...	1,309,252	1	......	1,169,306	July 28,'14	.02
May Day....	Utah ..	800,000	0 25	40,000	284,000	May 26,'16	.02
Mary Murphy,g.s.l.z	Colo...	370,000	5	......	50,134	Dec. 10,'15	.07
Mexican, g.s....	Nev...	201,600	3	......	171,360	June 4,'14	.75
Miami, c....	Ariz...	747,113	5	2,054,563	7,454,442	May 15,'16	1.50
Mine La Motte, l....	Mo. ...	300,000	10	......	300,000	Jan. 23, '04	.20
Modoc, g. s....	Colo...	500,000	1	......	275,000	Oct. 20, '11	.01
Mogollon, g. s....	N. M..	355,682	1	......	130,000	Oct. 1, '15	.10
Mohawk, c....	Mich..	100,000	25	700,000	4,575,000	Feb. 1, '16	7.00
Moh'k Com. Lease.	Nev...	500,000	1	......	115,000	July 22,'08	.08
Moh'k (Goldfield)..	Nev...	710,000	1	......	568,000	Nov. 25 '07	.30
Moh'k Jumbo Lease	Nev...	600,000	1	......	198,000	Nov. 20 '08	.03
Mon'ch Madonna, g	Colo...	1,000,000	1	......	40,000	May 16, '11	.01
Mont. Ore Purch....	Mont .	80,833	25	......	9,448,119	Jan. 29, '07	15.00
Mont-Tonopah, g....	Nev...	1,000,000	1	......	530,000	Dec. 20,'12	.10
Monument, g....	Colo...	300,000	1	......	27,124	Apr. 28, '05	.01
Morning Star Drift.	Cal. ...	2,400	100	......	854,400	Sept. 26 '00	3.00
Moscow, s. l. c. z....	Utah..	797,601	1	......	67,480	Dec 20,'14	.03
Mountain, c....	Cal. ...	250,000	25	......	4,216,250	May 14 '08	.44
Mountain View....	Utah ..	139,720	1	......	12,554	Aug. 6, '06	.06
Mt. Diablo, s....	Nev...	50,000	100	......	260,271	Jan. 28, '00	.10
Mt. Rosa, g....	Colo...	994,850	1	......	19,897	Nov. 8, '05	.01
Napa Con., q....	Cal. ...	100,000	7	......	1,840,000	July 20,'11	.40
National, g....	Nev...	750,000	1	......	570,000	May 1, '11	.10
National Lead, com	U. S...	206,554	100	206,551	9,245,793	Mar. 31,'16	1.00
National Lead, pf..	U. S...	243,676	100	426,501	32,479,061	Mar. 1, '16	1.75
National, z. l....	Mo. ...	500,000	1	45,000	60,000	May 31,'16	.05
Nevada Con. c....	Nev...	2,000,000	5	1,000,000	20,975,893	Mar. 31,'16	.50
Nevada Douglas....	Nev...	922,860	5	......	125,000	Jan. 1, '13	.12½
Nevada Hills, g....	Nev...	746,000	5	......	373,716	Dec. 20, '07	.10
Nev. Keystone, g....	Nev...	638,887	1	......	61,700	Feb. 18, '04	.03
Nevada Wonder....	Nev...	1,408,240	1	......	633,528	Nov.20,'15	.05
New Baltic....	Mich..	70,000	25	......	35,000	July 15,'15	.50
New Century, z....	Mo. ...	300,000	1	......	1,170,000	Oct. 26, '09	.01
Newhouse, l. c....	Utah ..	600,000	10	......	600,000	Nov. 20 '07	.10
New Idria, q....	Cal. ...	100,000	5	100,000	1,930,000	Mar. 2,'16	1.00
New Jersey, z....	U. S...	100,000	100	11,550000	......	May 10,'16	9.00
New Zealand Con....	Colo...	675,000	1	......	129,600	Mar. 7, '02	.50
North Butte, c. g. s.	Mont .	430,000	15	430,000	12,507,000	Apr. 17,'16	.50
North Star, g....	Cal. ...	250,000	10	50,000	4,837,040	Mar. 30,'16	.20
O. P. David, z....	Wis. ..	120,000	1	......	144,000	May 16,'11	.04
Old Colony, z....	Mo....	69,909	10	......	138,184	Nov. 7. '01	.25
Old Dominion Co., h	Ariz...	293,353	25	733,382	8,058,860	Mar. 31,'16	2.50
Old Dominion, m&s	Ariz...	162,000	25	405,000	5,022,000	Mar. 30,'16	2.50
Old Town Con., g....	Colo...	2,809,286	1	......	162,577	Aug. 7. '05	.00½
Ontario, s. l....	Utah ..	150,000	100	......	13,917,500	Dec. 7, '02	.30
Ophir, g. s....	Nev...	201,600	3	......	2,088,520	Jan. 25,'12	.10
Opohongo, c. g. s....	Utah ..	898,978	0 25	......	71,818	Jan. 30,'13	.01
Optimo, z....	Wis...	490	100	......	44,800	Sept. 1,'15	10.00
Oroville Dredging..	Cal.. ..	697,936	5	84,000	2,416,500	Mar 21,'16	.12
Oroville Union, g....	Cal. ...	52,154	1	14,759	45,494	May 12,'16	.10
Osceola, c....	Mich..	96,150	25	673,050	13,621,925	Apr. 29,'16	4.00
Osceola, l. z....	Mo. ...	98,000	6	......	220,709	Oct. 1, '12	.05
Parrot, c....	Mont .	229,850	10	......	7,577,264	May 15,'16	.15
Peacock....	Wis. ..	5,000	100	50,000	152,500	May 31,'15	20
Pearl Con., g. s....	Wash.	1,970,710	5	......	187,216	Sept. 6, '10	.02

Continued on next page.

Dividends of Mines and Works—Continued

NAME OF COMPANY		Number Shares Issued	Par Val	Dividends on Issued Capitalization: Paid in 1916	Total to Date	Latest: Date	Amt.
Petro, g. s.	Utah	500,000	$1	$........	$65,000	Aug. 9, '06	$0.04
Pharmacist, g.	Colo.	1,500,000	1	....	91,500	Feb. 1, '10	.00½
Phelps, Dodge & Co	U. S.	450,000	100	2,700,000	48,371,527	Mar. 31,'16	6.00
Pioneer, g.	Al'ska	5,000,000	1	....	2,041,526	Oct. 7, '11	.03
Pittsburg, l. z.	Mo.	1,000,000	1	....	20,000	July 15,'07	.02
Pittsburg-Idaho, l.	Ida.	1,000,000	1	....	249,104	July 15,'13	.04
Pitts Silver Peak	Nev	2,790,000	1	....	840,600	Dec. 1, '14	.02
Platteville, l. z.	Wis.	500	60	....	179,500	June 15 '07	10.00
Plumas Eureka, g.	Cal.	150,625	10	....	2,831,294	Apr. 8, '01	.06
Plymouth Con.	Cal.	240,000	5	....	172,800	Dec. 29,'15	.24
Portland, g.	Colo.	3,000,000	1	180,000	10,357 080	Apr. 20,'16	.03
Prince Con., s. l.	Nev.	1,000,000	2	75,000	200,000	Apr. 1, '16	.05
Quartette, g. s.	Nev.	100,000	10	....	375,000	July 31, '07	.20
Quicksilver, pf.	Cal.	43,000	100	....	1,931,411	Apr. 8, '03	.50
Quilp, g.	Wash.	1,500,000	1	.....	67,000	Feb. 1, '12	.01
Quincy, c.	Mich.	110,000	25	330,000	22,107,500	Mar. 20,'16	3.00
Ray Con., c.	Ariz.	1,460,804	10	774,464	5,350,591	Mar. 31,'16	.50
Red Bird, g. s. c. l.	Mont.	300,000	5	....	72,000	Oct. 9, '04	.01
Red Metal, c.	Mont.	100,000	10	....	1,200,000	Apr. 1, '07	4.00
Red Top, g.	Nev.	1,000,000	1	....	128,175	Nov.25, '07	.10
Republic, g	Wash.	1,000,000	1	....	85,000	Dec. 28, '10	.01½
Richmond, g. s. l.	Nev.	54,000	1	....	4,453,797	Dec. 23, '00	.01
Rocco-Home, l. s.	Nev.	300,000	1	....	152,500	Dec. 22, '05	.02
Rochester Ld. & L.	Mo.	4,900	100	....	190,846	July 1, '12	.50
Round Mountain, g.	Nev.	889,018	1	....	363,964	Aug.25,'13	.04
Sacramento, g.	Utah	1,000,000	5	....	308,000	Oct. 22, '06	.00½
St. Joseph, l.	Mo.	1,464,798	10	352,350	10,620,248	Mar. 20, 16	.25
St. Mary's M. L.	Mich.	160,000	25	1,120,000	6,080,000	May 29,'16	2.00
Schoenh'r-Wal'n,z.l	Mo.	10 000	10	....	90,000	Sept.20,'11	.20
Scratch Gravel	Cal.	1,000,000	1	20,000	20,000	Feb. 1, '16	.02
Seven Tro. Cn., g. s.	Nev	1,453,007	1	36,250	252,743	Apr. 1, '15	.02½
Shannon, c.	Ariz	300,000	10	....	750,000	Jan 30,'13	.50
Shattuck-Ariz., c.	Ariz	350,000	10	787,500	3,762,500	Apr. 20,'16	1.25
Silver Hill, g. s.	Nev.	108,000	1	....	88,200	June 24 '07	.05
*Silver King Coal'n	Utah	1,250,000	5	375,000	13,959,885	Apr. 1, '16	.15
Silver King Con.	Utah	637,582	1	63,758	878,615	Apr. 22,'15	.10
Silver Mines Expl.	N. Y.	10,000	100	....	250,000	June 16 '10	2.00
Sioux Cons., l. s. c.	Utah	745,389	1	....	872,105	July 20,'11	.04
Skidoo, g.	Cal.	1,000,000	5	....	365,000	Oct 2, '14	.01
Smuggler, s. l. z.	Colo	....	1	....	2,235,000	Nov.22,'06	.03
Snowstorm, c.	Idaho	1,500,000	1	....	1,169,610	Oct. 10, '13	.01½
Socorro	N. M.	377,500	5	18,865	158,335	Feb. 15,'16	.05
South Eureka, g.	Cal.	299,981	1	104,950	1,346,784	May 15,'16	.07
So. Swansea, g. s. l.	Utah	300,000	1	....	287,500	Apr. 3, '04	.01½
Spearfish, g.	S. D.	1,500,000	1	....	165,500	Jan. 7, '05	.01
Standard Con., g. s.	Cal.	178,394	10	....	5,274,408	Nov.17,'13	.25
Standard, c.	Ariz	425,000	1	....	69,500	Sept. 8, '05	.50½
Stewart, l z.	Idaho.	1,238,362	1	....	2,043,297	Dec. 31,'15	.05
Stratton's Crip. Ck.	Colo	2,000,000	1	....	300,000	Sept. 6, '08	.02½
Stratton's Ind.	Colo	1,000,000	5	....	5,028,568	Dec. 23, '06	0.12
Str'n's Ind. (new)g.	Colo	1,000,000	.60	160,000	691,250	Jan. 31,'16	.16
Strong, g.	Colo	1,000,000	1	....	2,275,000	July 9, '05	.02

NAME OF COMPANY		Number Shares Issued	Par Val	Dividends on Issued Capitalization: Paid in 1916	Total to Date	Latest: Date	Am.
Success	Ida.	1,500,000	$1	$255,000	$1,160,000	May 23,'16	$0.03
Superior & Pitts., c.	Ariz	1,499,792	10	....	10,318,568	Dec. 21,'15	.38
Swansea, s. l.	Utah	100,000	5	....	334,500	Apr. 29,'07	.05
Tamarack, c.	Mich.	60,000	25	....	9,420,000	July 23,'07	4.00
Tamarack-Custer	Idaho	2,000,000	1	40,000	40,000	May 1, '16	.02
Tennessee, c.	Tenn	200,000	25	300,000	5,206,250	Apr. 15,'16	.75
Tightner	Cal.	100	100	....	160,000	Jan. 3, '14	...
Tomboy, g. s.	Colo.	310,000	5	....	3,659,000	Dec, 31,'15	.24
Tom Reed, g.	Ariz.	909,555	1	....	2,555,934	Sept. 5,'15	.01
Ton.-Belmont, g.	Nev.	1,500,000	1	375,008	8,018,026	Apr. 1, '16	.12½
Ton. Extension, g. s.	Nev.	1,272,301	1	190,888	1,178,084	Apr. 1, '16	.10
Tonopah, g. s.	Nev.	1,000,000	1	300,000	13,300,000	Apr. 21,'16	.15
Tonopah Midway, g	Nev.	1,000,000	1	....	250,000	Jan. 1, '07	.05½
Town Topics, g. s.	Colo.	1,000,000	1	....	50,000	Nov. 7, '03	.00
Tremnis	Cal.	200,000	2.50	....	234,000	Apr. 28',15	.02
Tri-Mountain, c.	Mich.	100,000	25	....	1,100,000	Oct. 30, '12	3.00
Tuolumne, c.	Mont.	800,000	1	....	495,525	Apr. 15,'13	.10
Uncle Sam Con, s.	Utah	500,000	1	....	470,000	Sept.20,'11	.05
Union, g.	Colo	1,250,000	1	....	444,244	Jan. 27, '03	.02
Union Basin, z.	Ariz	835,350	1	....	167,070	Nov. 16,'15	.10
United, c., pf.	Mont	50,000	100	....	1,500,000	Apr. 15, '07	3.00
United, c., com.	Mont.	450,000	100	....	6,125,000	Aug. 6, '07	1.75
United, z. l., pf.	Mo.	19,556	25	....	211,527	Oct. 15, '07	.50
United Copper, c. s.	Wash.	1,000,000	1	.... ..	40,000	Dec. 21,'12	.01
United (Crip. Ck)	Colo.	4,009,100	1	....	440,435	Jan. 1, '10	.04
United Globe, c.	Ariz.	23,000	100	345,000	3,001,500	Mar.30, '16	15.00
United Metals Sell.	U. S.	50,000	100	....	11,000.000	Sept. 23 '10	5.00
United Verde, c.	Ariz.	300,000	10	1,350,000	37,372,000	May 3,' 16	.75
U.S. Red. & R., com.	Colo.	59,188	100	....	414,078	Oct. 9, '03	1.00
U. S. Red & R., pf.	Colo.	39,458	100	....	1,775,936	Oct. 1, '07	1.50
U.S. S. R. & M., com	USMx	351,105	50	614,351	7,239,630	Apr. 15,'16	.75
U. S. S. R. & M., pf.	USMx	486,350	50	859,112	17,654,810	Apr. 15,'16	.87½
Utah, c	Utah	1,624,489	10	4,061,225	36,783,122	Mar. 31,'16	2 50
Utah, s. l. (Fish Sps)	Utah	93,000	10	....	283,720	Oct. 21, '10	.02½
Utah-Apex, s. l.	Utah	528,200	5	132,050	198,075	Apr. 1, '16	.12½
Utah Con., c.	Utah	300,000	5	225,000	9,375,000	Apr. 10,'16	.75
Victoria, g. s. l.	Utah	250,000	1	....	207,500	Apr. 23, '10	.04
Vindicator Con., g.	Colo.	1,500,000	1	90,000	3,352,500	Apr. 25,'16	.03
Wasp No. 2, g.	S. D.	500,000	1	100,000	649,466	May 15,'16	.02½
Wellington, l. z.	Colo	10,000,000	1	200,000	850,000	Mar. 15,'16	.02
West End Con.	Nev	1,788,486	1	....	536,545	Jan. 15,'16	.05
West Hill	Wis.	20,000	1	. ..	28,000	Sept.29,'15	.20
White Knob, g. pf.	Cal.	200,000	10	20,000	150,000	Feb. 10,'16	10
Wilbert	Ida.	1,000,000	1	20,000	30,000	May 1, '16	.01
Wolverine, c.	Mich.	60,000	25	360,600	8,760,000	Apr. 1, '16	6 00
Wolverine & Ariz.,c	Ariz	118,674	15	....	53,403	........'15	.25
Work, g.	Colo	1,500,000	1	....	1,597,685	Apr. 31,'12	.02
Yak	Colo	1,000,000	1	....	2,007,685	Dec. 31,'15	.07
Yankee Con., g. s. l.	Utah	1,000,000	1	....	167,500	Feb. 1, '13	.01
Yellow Aster, g.	Cal.	100,000	10	15,000	1,187,789	Apr. 6, '16	.03
Yellow Pine	Cal.	1,000,000	1	350,000	1,043,008	May 25,'16	.15
Yosemite Dredg.	Cal.	24,000	10	.....	102,583	July 15,'14	.10

Corrected to June 1, 1916

*Includes dividends paid by Silver King Mg. Co. to 1907—$10,675,000

Dividends of Foreign Mines and Works

NAME OF COMPANY		Number Shares Issued	Par Val	Dividends on Issued Capitalization: Paid in 1916	Total to Date	Latest: Date	Amt.
Ajuchitlan	Mex.	50,000	$5	$	$237,500	July 1, '13	$0.25
Amistad y Concordia g s	Mex.	9,600	50	....	429,358	July 15,'08	1.28
Amparo, s. g.	Mex.	2,000,000	1	100,000	2,032,176	Feb. 10,'16	.05
Bartolo. de Medina Mill	Mex.	2,000	25	....	103,591	Aug. 1, '07	.50
Batopilas, s	Mex.	446,268	20	....	55,870	Dec. 31, '07	.12½
Beaver Con., s	Ont.	2,000,000	1	60,000	650,000	Apr. 29,'16	.03
Boleo, g	Mex.	120,000	20	......	721,871	May 8, '11	5.00
British Columbia, c.	B. C.	591,709	5	....	615,399	Jan. 5, '13	.15
Buena Tierra.	Mex	330,000	5	....	160,380	Jan. 30,'15	.24
Buffalo, Ont	Ont.	1,000,000	1	....	2,787,000	July 1, '14	.05
Canadian Goldfields	Can.	600,000	0.10	......	237,099	July 15,'14	.01¼
Cananea Central, c.	Mex.	600,000	10	....	360,000	Mar. 1, '12	.60
Cariboo Cobalt	Ont	1,000,000	1	....	295,000	Sept. 1,'15	.09
Cariboo-McKinney, g.	B. C.	1,250,000	1	. . .. .	56,250	Dec. 1. '09	.00½
City of Cobalt	Ont.	500,000	1	.. ....	138,375	May 15, '09	.01
Cobalt Central, s.	Ont.	4,761,500	1	......	192,845	Aug.24, '09	.01
Cobalt Lake, s	Ont.	3,000,000	1	.. . .	465,000	May 29,'14	.02½
Cobalt Silver Queen	Ont.	1,500,000	1	....	315,000	Dec, 1, '08	.03
Cobalt Townsite, s.	Ont.	199,282	5	....	1,042,259	Aug 20,'14	.24
Coniagas, s	Ont.	800,000	5	200,000	8,040,000	Feb. 5, '16	.25
Con. Mg. & Sm., g. s. c.	B. C.	58,502	100	290 262	2,407,246	Apr. 1, '16	2.50
Crown Reserve, s.	Ont.	1,999,957	1	....	6,102,408	July 15,'15	.03
[illegible]	Mex.	400,000	5	. . ..	1,374,865	July 24,'11	.22½
[illegible]	Ont.	1,000,000	[illegible]	207,0[illegible]	600,000	Mar. 1, '16	.50
Dos Estrellas, (El Oro)	Mex.	300,000	[illegible]	......	15,405,000	Sept.30,'13	1.50
El Favor	Mex.	3,500,000	1	....	210,000	Apr. 30,'14	.01
El Oro, g. s.	Mex.	1,147,500	5	......	9,136,842	July 11,'13	.24
El Rayo, [illegible]	Mex.	260,020	2	.....	140,410	Apr. 24,'11	.15
El Triunfo, c	Mex.	2,000,000	1	....	20,000	Aug. 28,'11	.01
Esperanza, s. g.	Mex.	450,000	5	......	12,521,250	Dec. 31,'15	.10
Granby Con., c. g. s.	B. C.	149,985	100	449,956	6,050,341	May 1, 16	1.50
Greene Cananea, c	Mex.	41[illegible]	100	[illegible]	[illegible]	May 29,'16	1.00
Greene Con., c	Mex	1,000,000	10	[illegible]	10,544 000	Jan. 26,'16	.50
Greene Gold Silver, pf.	Mex.	300,000	10	......	[illegible]	Mar. 28,'07	.40
Guanajuato Con	Mex.	540,000	[illegible]	..	[illegible]	Oct. 8, '06	.07½
Guanajuato Dev., pf.	Mex	10,000	100		[illegible]	Jan. 1, '11	3.00
Guggenheim Explorat.	Mex	833,732	25	13,339,712	[illegible]	Jan. 3, '16	16.00
Haileybury, s.	Ont	50,000	1	....	[illegible]	Apr. 5, '11	.50
Hedley	B. C.	120,000	10	60,000	[illegible]	Mar. 31,'16	.50
Hinds Con., g. s. l.	Mex.	5,000,000	1	. ..	[illegible]	Feb.27, 08	.02
Hollinger	Ont.	600,000	[illegible]	[illegible]	4,790,000	May 18,'16	.20
Jimulco, c.	Mex.	10,000	100	....	975,000	Feb. 27,'11	1.00
Kerr Lake, s.	Ont.	600,000	5	150,000	[illegible]	Mar. 15,'16	.25
La Blanca	Mex.	140,000	20	. ....	[illegible]	Mar.31,'13	.90
La Republica, s.	Mex.	400,000	5	.....	[illegible]	Aug. 15,'11	.06
La Rose Con., s.	Ont	1,498,627	5	149,862	5,536,982	Apr. 20,'16	.05

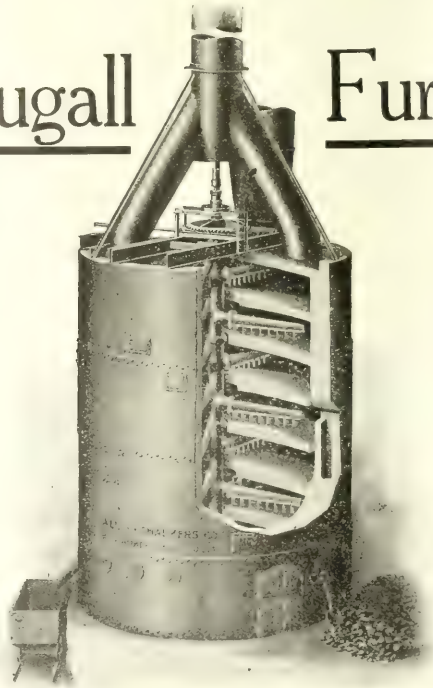
NAME OF COMPANY		Number Shares Issued	Par Val	Dividends on Issued Capitalization: Paid in 1916	Total to Date	Latest: Date	Amt.
Las Cabrillas	Mex.	1,040	$10	$.......	$591,400	June 3,'12	10.00
Le Roi No. 2, g.	B. C.	120,000	25	....	1,435,520	Dec. 15,'15	$0.24
Lucky Tiger	Mex.	715,337	10	150,221	3,413,612	May 20,'16	.09
McKinley-Darragh-Sav.	Ont.	2,247,692	1	67,431	4,742,630	Jan. 1, '16	.03
Mexican, l., pf.	Mex.	12,500	100	....	1,018,750	May 1, '12	3.50
Mexico Con.	Mex.	240,000	10	....	660,000	Mar.10, '08	.25
Mexico Mines of El Oro	Mex.	180,000	5	....	4,478,500	June26,'14	.96
Minas Pedrazzini	Mex.	1,000,000	1	....	497,500	Jan. 23, '11	.06½
Mines Co. of Am.	Mex.	900,000	10	....	4,958,600	July 25,'13	12½
Mining Corp. of Canada.	Can.	2,075,000	1	....	2,430,384	Nov.16,'15	.12½
Montezuma, l. pf.	Mex.	5,000	100	....	402,500	Nov. 15,'12	3.50
Montezuma M. & Sm.	Mex.	500,000	1	....	100,000	July20, '09	.04
Mother Lode	B. C.	1,250,000	1	137,500	137,500	Jan. 3, '16	.11
Naica, s. l.	Mex.	100	300	....	3,190,000	Oct. 11, '09	$283
N. Y. & Hond. Rosario.	C. A.	200,000	10	140,000	3,890,000	Apr. 28,'16	.50
Nipissing, s	Ont.	1,200,000	5	600,000	14,040.000	Apr. 20,'16	.25
North Star, s. l.	B. C.	1,300,000	1	....	533,000	Feb. 1, '10	.02
Paloma, g.	Mex.	3,000	...	....	99,600	Dec. 1, '12	5.00
Panuco	Mex.	10,000	....	....	7,465,000	Nov. 4, '09	5.00
Penoles, s. g.	Mex.	120,000	20	....	6,451 687	Sept,30,'13	1.25
Peregrina, pf.	Mex.	10,000	100	......	328,656	Sept. 1, 10	3.50
Peterson Lake	Ont.	2,401,820	1	84,064	336,256	Apr. 1, '16	.01¾
Pinguico, pf.	Mex.	20,000	100	....	780,000	Apr. 15,'13	3.00
Porcupine Crown	Ont.	2,000,000	1	60,000	480,000	Jan. 2, '16	.03
Providencia, (S. J.)	Mex.	6,000	15	....	963,360	Apr. 1, '08	1.00
Rambler-Cariboo	Ont.	17,500	100	17,500	327,500	Apr. 15,'16	.01
Rea Mines, Leasing	Ont.	200,000	1	....	12,750	Feb. 20,'15	.06½
Right of Way	Ont.	1,685,500	1	25,282	569,041	Mar. 15,'16	.01½
Rio Plata	Mex.	374,518	5	....	345,744	Feb. 1, '13	.05
San Francisco Mill	Mex.	6,000	25	....	445,086	Oct. 15, '08	1.00
San Rafael,	Mex.	2,400	25	....	6,798,260	Jan. 11,'12	2.00
San Toy, s. l	Mex	6,000,000	1 00	.. ....	540,000	July 24,'13	.01
Santa Gertrudis, Hdgo,.	Mex.	1,500,000	5	....	2,455,272	Nov.16,'15	.24
Sta. Gert'y Guadalupe,g.s	Mex.	60,000	....	....	3,960,000	Mar.27, 09	1.00
Sta. Maria del Paz.	Mex.	9,600	12½	.. .	5,606,000	Jan. 2, '13	2.50
Seneca-Superior	Ont.	478,884	1	191,536	1,172,748	May 15,'16	.20
Soledad, s. l.	Mex.	960	20	....	4,439,840	Oct. 17, '11	8.00
Sorpresa, g. s.	Mex.	19,200	20	... ...	3,979,240	Jan. 5, '11	34.00
Standard, s. l.	B. C.	2,000,000	1	50,000	2,050,000	May 10,'16	.02½
Temiscamg' & Hud. Bay	Ont.	7,761	1	... .	1,940,250	Nov.10,'14	3.00
Temiskaming, s.	Ont.	2,500,000	1	75,000	1,534,156	Mar. 15.'16	.03
Teziutlan, c	Mex.	8,000	100	....	1,955,000	Jan. 1, '09	1.50
Tough-Oakes	Ont.	531,500	5	132,874	199,261	Apr. 3, '16	.12
Tretheway, s.	Ont.	1,000,000	1	....	1,061,988	July 15,'14	.05
Wettlaufer-Lorrain, s.	Ont.	1,416,590	1	. ....	656,386	Oct. 20, '13	.05
Yukon, g.	Y. T.	3,500,000	5	262,500	7,845,100	Mar.31 '16	.07½

Corrected to June 1, 1916.

Successful Copper Smelting

Involves a number of separate and distinct operations; one of the most important of these is the partial elimination of the sulphur by roasting, preliminary to smelting.

The McDougall Furnace



has proved its worth in the roasting of copper sulphide ores and is particularly effective on concentrates, utilizing to the utmost the fuel value of the sulphur in the ore.

It requires a minimum of power and repairs, has the greatest hearth area per unit of building space and consequently the greatest capacity. It can be adapted to roast any kind of ore.

IF YOU HAVE A ROASTING PROBLEM CONSIDER THE McDOUGALL.

Allis-Chalmers Manufacturing Co.

Mining Machinery Dept. - Milwaukee, Wisconsin

Offices in All Principal Cities.

For all Canadian Business refer to Canadian Allis-Chalmers, Ltd., Toronto, Ont., Canada

"Where-To-Buy"

Under this head is listed the Equipment, Supplies, etc., in general demand in Mines, Mills, Smelters, etc., and the companies or firms manufacturing same, whose advertisements appear regularly in Mining and Engineering World.

— PINE —
FLOTATION OILS
Pensacola Tar & Turpentine Company
F. E. Mariner, Pres. Gull Point, Fla.

FLOTATION
"An Oil for Every Ore"
PINE OILS - PINE TAR OILS - COAL TAR OILS - WOOD CREOSOTES
GENERAL NAVAL STORES CO., 175 Front Street, New York

FLOTATION OILS PURE PINE PRODUCTS NO MIXED OILS
If one of our oils does your work you will get the same oil every time. *We MAKE them.*
Georgia Pine Turpentine Co.
156-60 Perry Street : : : New York
Works: Fayetteville, N. C., Collins, Ga.

HARDINGE MILLS
FOR ECONOMICAL FINE GRINDING

HARDINGE CONICAL MILL CO.
120 BROADWAY, NEW YORK

Denver Quartz Mills and Denver Steel Crushers
have that kind of reliability that constantly and continuously keeps on being reliable.
The Denver Quartz Mill & Crusher Co.
216-17 Colorado Bldg., Denver, Colo., U. S. A

Sintering Fine Ores
FOR BLAST FURNACES and Other Purposes
Dwight & Lloyd Sintering Company, Inc.
Columbia Building, 29 Broadway, New York
Cable Address: Sinterer-New York

ABRASIVES

Pumice
Heil Chemical Co.

Regrinding Compound
Lunkenheimer Co.

AERIAL CABLEWAYS
See Cableways.

AGITATORS
See Cyanide Equipment.

AIR COMPRESSORS
Allis-Chalmers Mfg. Co.
Chicago Pneumatic Tool Co.
Clayton Air Compressor Co.
De Laval Steam Turbine Co.
Denver Hydro Co.
General Electric Co.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.
International Steam Pump Co.
Laidlaw-Dunn-Gordon Co.
McKiernan-Terry Drill Co.
Monarch Eng. & Mfg. Co.
Moore & Co. Engrs., Chas. C.
Nordberg Mfg. Co.
Norwalk Iron Works Co.
Wellman-Seaver-Morgan Co.

Fuel Oil
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Standard Oil Co.

Hydraulic
Morse Bros. Mchy. & Sup. Co.

ALTERNATORS
See Electrical Equipment.

ALUMINUM PRODUCTS
Heil Chemical Co.

AMALGAMATING EQUIPMENT
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Hendrie & Bolthoff M. & S. Co.
Johnson Engineering Works.
Lane Mill & Machy. Co.
Morse Bros. Mchy. & Sup. Co.
Pierce, L. S.
Traylor Engineering & Mfg. Co.
See also Mercury.

AMMETERS
See Electrical Equipment.

ASBESTOS AND INSULATORS

Asbestos Products
Heil Chemical Co.

Packing
Allis-Chalmers Mfg. Co.
Goodrich Co., The B. F.
Jenkins Bros.

Pipe Covering
Allis-Chalmers Mfg. Co.
Jenkins Bros.

ASSAYERS
See Professional Directory.

ASSAYERS SUPPLIES
See Chemists' and Chemical Supplies.

ATTORNEYS
See Professional Directory.

AUTO TRUCKS
See Motor Trucks.

AXLES
See Cars and Accessories.

BABBIT METALS
Skinner & Co., M. B.

BALL MILLS AND ACCESSORIES
See Crushing and Grinding Equipment.

BEARINGS
Hyatt Roller Bearing Co.
Robins Conveying Belt. Co.

BELT CONVEYORS
See Conveyors and Elevators.

BELTING AND ACCESSORIES

Belt Dressing
Chicago Belting Co.
Gandy Belting Co.

Cotton Belting
Gandy Belting Co.

Leather Belting
Chicago Belting Co.
Dick, Ltd., R. & J.
Goodrich Co., The B. F.
Schieren Co., Chas. A.

Link or Chain Belting
Bartlett & Snow Co.
Link-Belt Co.
Morse Chain Co.

Rubber Belting
Bartlett & Snow Co.
Chicago Belting Co.
Dick, Ltd., R. & J.
Goodrich Co., the B. F.
Gutta Percha & Rubber Mfg. Co.

Transmission Belts
Chicago Belting Co.
Dick, Ltd., R. & J.
Gandy Belting Co.
Gutta Percha & Rubber Mfg. Co.

BINS
See Hoppers.

BLACKSMITH TOOLS
Chicago Pneumatic Tool Co.

BLASTING SUPPLIES
See Explosives, etc.

BLOCKS
See Chain and Chain Blocks.

BLOWERS
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Connersville Blower Co.
De Laval Steam Turbine Co.
General Electric Co.
Ingersoll-Rand Co.
International Steam Pump Co.
Morse Bros. Mchy. & Sup. Co.
Monarch Eng. & Mfg. Co.
Nordberg Mfg. Co.
Roots Co., P. H. & F. M.
Southwark Fdy. & Mch. Co.
Worthington, Henry R.
See also Fans.

BOILER GRAPHITE
See Graphite Products.

BOILERS AND ACCESSORIES
See Steam Boilers, etc.

BOOKS AND LITERATURE
Mining World Co.

BORING CONTRACTORS
Diamond Drill Contracting Co.
Staley, Harry D.
Standard Diamond Drill Co.

BORING EQUIPMENT
See Drilling and Boring Equipment.

BORTZ
See Drilling and Boring Equipment.

BOSSHEADS
See Crushing and Grinding.

BRAKES (Hoisting)
See Hoisting Equipment.

BRASS AND BRONZE GOODS
Jenkins Bros.
Lunkenheimer Co
National Tube Co.
Wm. Powell Co.

BRIDGES

Suspension
Roebling's Sons Co., John A.

BREATHING APPARATUS
Elmer, H. N.
Siebe, Gorman & Co.

BRIQUETTING MACHINERY
Traylor Engineering & Mfg. Co.

BROKERS AND BANKERS
Craig, W. J.
Damschroeder, H. L.
Pearce, W. D.

BUCKETS AND BASKETS
Ambursen Co. (Tramways).
Link-Belt Co.
Traylor Engineering & Mfg. Co.
Wellman-Seaver-Morgan Co.

BUCKET ELEVATORS
See Conveyors and Elevators.

BURNERS (Gas and Oil)
Monarch Eng. & Mfg. Co.
National Transit Co.
Wellman-Seaver-Morgan Co.

CABLEWAYS

Aerial Cableways
Ambursen Co. (Tramways).
American Steel & Wire Co.
Broderick & Bascom Rope Co.
Flory Mfg. Co.
Lidgerwood Mfg. Co.
Morse Bros. Mchy. & Sup. Co.
Riblet Tramway Co.
Roebling's Sons Co., John A.

Pulley Blocks
Broderick & Bascom Rope Co.
Lidgerwood Mfg. Co.

Wire-Rope Greaser
Broderick & Bascom Rope Co.

CAMS
See Crushing and Grinding

CANDLES
See Lighting Equipment.

CANDLESTICKS
See Lighting Equipment.

CAPS (Explosive)
See Explosives and Blasting.

CARBIDE LAMPS
See Lighting Equipment.

CARBONS AND BORTZ
See Drilling and Boring Equipment.

CARS AND ACCESSORIES

Car Axles
Standard Forging Co.

Car Tippers
Atlas Car & Mfg. Co.
Wellman-Seaver-Morgan Co.

Car Trucks
Atlas Car & Mfg. Co.
Chalmers & Williams.

Car Wheels
Atlas Car & Mfg. Co.
Lehigh Car, Wheel & Axle Wks.
Queen City Foundry Co.

Dump, Mine or Ore Cars and Skips
Atlas Car & Mfg. Co.
Chalmers & Williams.
Hendrie & Bolthoff M. & S. Co.
Moore & Co. Engrs., Chas. C.
Morse Bros. Mchy. & Sup. Co.
Traylor Engineering & Mfg. Co.
Wellman-Seaver-Morgan Co.

Mill and Smelter Cars
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Hendrie & Bolthoff M. & S. Co.
Monarch Eng. & Mfg. Co.
Moore & Co. Engrs., Chas. C.
Morse Bros. Mchy. & Sup. Co.
Traylor Engineering & Mfg. Co.
Wellman-Seaver-Morgan Co.
See also Clips and Couplings for Car Accessories.

CASTINGS

Brass, Bronze, White Metal
Bartlett & Snow Co.
Lunkenheimer Co.

Iron and Steel
American Steel & Wire Co
Bartlett & Snow Co.
Danville Fdy. & Mch. Co.
Lunkenheimer Co.
Queen City Foundry Co.
Robins Conveying Belt. Co.
Standard Forgings Co.
Wellman-Seaver-Morgan Co.

Malleable
Bartlett & Snow Co.
Monarch Eng. & Mfg. Co.

CEMENT
Skinner & Co., M. B.

CEMENT AND CONCRETE MACHINERY

Cement Machinery
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Fawcus Co.
International Steam Pump Co.
Lehigh Car, Wheel & Axle Wks.
Power & Mining Machinery Co.
Ruggles-Cole Eng. Co.

Concrete Mixers
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Fawcus Co.
International Steam Pump Co.
Power & Mining Machinery Co.

Lime Machinery
Allis-Chalmers Mfg. Co.
Fawcus Co.
Lehigh Car, Wheel & Axle Wks.
Traylor Engineering & Mfg. Co.

Sandlime-Brick Machinery
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Fawcus Co.
Traylor Engineering & Mfg. Co.

CHAIN AND CHAIN BLOCKS
Broderick & Bascom Rope Co.
Flory Mfg. Co.
Robins Conveying Belt. Co.
Taylor Chain Co.

Continued on Next Page.

KEYSTONE
Copper Steel Sheets
Black and Galvanized, durable, rust-repellent. APOLLO-KEYSTONE Galvanized Sheets are unequaled for Culvert, Flumes, Roofing, Etc.
AMERICAN SHEET AND TIN PLATE COMPANY, Pittsburgh, Pa.

DIAMOND DRILLS
WE make the most complete line in the world. 350 ft. to 6,000 ft. Hydraulic feed, screw feed, hand power, horse power, gasoline, steam, air and electricity. *Send for catalog.*
STANDARD DIAMOND DRILL COMPANY
745 First National Bank Building CHICAGO

Diamond Drill Contracting Company
429 First Ave., Spokane, Wash. Rosaland, British Columbia
Contractors for All Kinds of Diamond Drill Work
Write for Prices.

McKIERNAN-TERRY DRILL COMPANY
Manufacturers of
Rock Drills, Hammer Drills, Core Drills, Pile Hammers, Atlas Jacks.
231 Broadway, NEW YORK.

CARBONS (Black Diamonds) & BRAZILIAN BORTZ
Finest Quality. Carbons sent for selection.
Lowest Prices. Direct Brazilian Importers.
FRANCIS & CO.
50 State Street,
HARTFORD, CONN.

Carbon (Black Diamonds) and Bortz
For Diamond Drills and All Mechanical Purposes
ABR. LEVINE, 35 Nassau St., New York
Highest Prices Paid For Used Stones and Fragments.

Wood Drill Works
Paterson, N. J.
Manufacturers of the Drill that can be "Cleaned up with a Sledge Hammer" and "Wiped off with a Scoop Shovel", and yet "Stay with you."
Branch:
Wood Drill Works, 516 West Lake Street, Chicago, Ill.
Agents:
Joshua Hendy Iron Works, 75 Fremont St., San Francisco, Cal.
Gardner Machinery Company, 620 Joplin St., Joplin, Mo.
H. C. Darnell & Co., Kansas City, Mo.
Pocatello Eng. & Mchy. Co., Pocatelo, Idaho

"EMPIRE"
DREDGES and DRILLS
NEW YORK ENGINEERING COMPANY
2 Rector Street, New York

YUBA
GOLD DREDGES
Yuba Ball Tread Tractors Yuba Centrifugal Pumps
THE YUBA CONSTRUCTION CO.
WORKS: Marysville, Cal. SALES OFFICE: 433 California St., San Francisco, Cal.

DREDGES FOR GOLD AND TIN
UNION CONSTRUCTION CO.
604 Mission St., San Francisco, Cal.
NEILL JIGS
UNION CHURN DRILLS
BOLINDER OIL ENGINES
Agents for
Bucyrus Company

Boilers for Mule Back Transportation
DO YOU NEED ONE?
Send for Catalog, to
ALMY WATER TUBE BOILER CO.
Providence, R. I., U. S. A.

METAL SCREENS OF ALL KINDS
Chicago Perforating Co.
24th Place and Western Ave.
Tel. Canal 1459 CHICAGO, ILL.

For Economy use
"FULLERITE"
Metallic Tube Mill Linings
Write for Information.
Lehigh Car, Wheel & Axle Works, Catasauqua, Pa., U.S.A.

STEAM TURBINES
By James Ambrose Moyer, S. B., A. M.
Member of the American Society of Mechanical Engineers
8vo, xi + 430 pages, 225 figures. Cloth, $3.50 net.
Note the change in price from $4.00 to $3.50 net.
MINING WORLD CO., Monadnock Blk., CHICAGO

James Concentrating and Slime Saving Devices
Jigs, Screens, Sand and Slime Tables, Classifiers, Automatic Ore Feeders, Etc.
Manufactured by
JAMES ORE CONCENTRATOR CO.
35 Runyon Street NEWARK, N. J.

CHAIN DRIVES
Morse Chain Co.

CHANNELLING MACHINES
See Cutting Machines.

CHEMICALS
See Chemists' Supplies.

CHEMISTS AND ASSAYERS
See Professional Directory.

CHEMISTS' AND CHEMICAL SUPPLIES
Assaying Furnaces
Heil Chemical Co.
Kalbfleisch Co., Franklin H.
Monarch Eng. & Mfg. Co.
Morse Bros. Mchy. & Sup. Co.
Balances
Heil Chemical Co.
Morse Bros. Mchy. & Sup. Co.
Thompson Balance Co.
Troemner, Henry.
Chemicals
Heil Chemical Co.
Kalbfleisch Co., Franklin H.
Morse Bros. Mchy. & Sup. Co.
Roessler & Hasslacher Ch. Co.
Laboratory Equipment
Abbé Engineering Co.
Heil Chemical Co.
Kalbfleisch Co., Franklin H.
Monarch Eng. & Mfg. Co.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Co.
Pulverizers (Laboratory)
Abbé Engineering Co.
Morse Bros. Mchy. & Sup. Co.

CHIMNEYS
Reinforced Concrete
Weber Chimney Co.

CHLORINATION EQUIPMENT
Allis-Chalmers Mfg. Co.
Traylor Engineering & Mfg. Co.

CLASSIFIERS
See Slime-Treating Equipment.

CLIPS AND COUPLINGS
Safety Hooks & Links.
Broderick & Bascom Rope Co.
Wellman-Seaver-Morgan Co.

CLUTCHES (Friction)
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Danville Fdy. & Mch. Co.
Goodman Manufacturing Co.
Link-Belt Co.
Morgan-Gardner Electric Co.
Wellman-Seaver-Morgan Co.

COAL MINE EQUIPMENT
See Cutting Machines, Explosives and Accessories, Hoisting Equipment.

COAL: PREPARING AND MARKETING EQUIPMENT
Breakers
Bartlett & Snow Co.
Hammond Iron Works.
Robins Conveying Belt Co.
Traylor Engineering & Mfg. Co.
Pulverizers
Abbé Engineering Co.
Robins Conveying Belt Co.
Screens
Bartlett & Snow Co.
Hammond Iron Works.
Link-Belt Co.
Robins Conveying Belt Co.
Traylor Engineering & Mfg. Co.
Wellman-Seaver-Morgan Co.
Coal Bins
Hammond Iron Works.
Tipples
Bartlett & Snow Co.
Hammond Iron Works.
Link-Belt Co.
Wellman-Seaver-Morgan Co.
Washeries
Bartlett & Snow Co.
Hammond Iron Works.
Wellman-Seaver-Morgan Co.
For other Coal Preparing and Marketing Equipment see Briquetting Machinery, Transport and Handling Equipment and Conveyors and Drying Apparatus.

COKING EQUIPMENT
Cars
Wellman-Seaver-Morgan Co.
Coke Ovens
Wellman-Seaver-Morgan Co.
Coke Quenchers
Wellman-Seaver-Morgan Co.
Coke Screens
Wellman-Seaver-Morgan Co.
Rams or Pushers
Wellman-Seaver-Morgan Co.

CONCENTRATORS
Dry
Allis-Chalmers Mfg. Co.
American Zinc Ore Separ'g Co.
Chalmers & Williams.
Wet
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Deister Machine Co.
Hendrie & Bolthoff M. & S. Co.
James Ore Concentrator Co.
Lane Mill & Mach. Co.
Senn Concentrator Co.
Moyle Engineering Works.
Traylor Engineering & Mfg. Co.
See also Separators.

CONCRETE MIXERS
See Cement and Concrete Machinery.

CONCRETE REINFORCEMENT
American Steel & Wire Co.
North Western Expanded Metal Co.

CONDENSERS (Steam)
See Steam Boilers, etc.

CONTROLLERS (Electric)
See Electrical Equipment.

CONVERTERS (Smelting)
Allis-Chalmers Mfg. Co.
International Steam Pump Co.
Power & Mining Machinery Co.
Traylor Engineering & Mfg. Co.

CONVEYORS AND ELEVATORS
Belt Conveyors
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Buchanan Co., C. G.
Chalmers & Williams.
Dick, Ltd., R. & J.
Gandy Belting Co.
Goodrich Co., The B. F.
Gutta Percha & Rubber Mfg. Co.
Robins Conveying Belt Co.
Chain Conveyors
Bartlett & Snow Co.
Buchanan Co., C. G.
Link-Belt Co.
Coal-Picking Belts
Bartlett & Snow Co.
Link-Belt Co.
Robins Conveying Belt Co.
Elevators
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Buchanan Co., C. G.
Chalmers & Williams.
Link-Belt Co.
New York Engineering Co.
Robins Conveying Belt Co.
Screw Conveyors
Bartlett & Snow Co.
Chalmers & Williams.
Link-Belt Co.

CORNER PLATES
See Structural Iron and Steel

COUPLINGS
Flexible
See Hose and Tubing.

COUPLERS (Hose)
See Hose and Tubing.

CRANES
Wellman-Seaver-Morgan Co.
Western Electric Co., Inc.

CRUSHING AND GRINDING EQUIPMENT
Ball Mills
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Bartlett & Snow Co.
Chalmers & Williams.
Hardinge Conical Mill Co.
Morse Bros. Mchy. & Sup. Co.
Traylor Engineering & Mfg. Co.
Wellman-Seaver-Morgan Co.

Boss Heads
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Moyle Engineering Works.
Traylor Engineering & Mfg. Co.

Chilean Mills
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Chalmers & Williams.
Hendrie & Bolthoff M. & S. Co.
International Steam Pump Co.
Morse Bros. Mchy. & Sup. Co.
Power & Mining Machinery Co.
Traylor Engineering & Mfg. Co.
Wellman-Seaver-Morgan Co.

Coal Breakers
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Bartlett & Snow Co.
International Steam Pump Co.
Power & Mining Machinery Co.
Traylor Engineering & Mfg. Co.

Crushing Rolls
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Bartlett & Snow Co.
Buchanan Co., C. G.
Chalmers & Williams.
International Steam Pump Co.
Lehigh Car, Wheel &AxleWks.
Morse Bros. Mchy. & Sup. Co.
Power & Mining Machinery Co.
Traylor Engineering & Mfg. Co.
Wellman-Seaver-Morgan Co.

Disintegrators
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Link-Belt Co.

Dry Crushers
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Bartlett & Snow Co.
Chalmers & Williams.
Denver Quartz Mill & Crusher.
Hardinge Conical Mill Co.
Johnson Engineering Works.
International Steam Pump Co.
Lehigh Car, Wheel &AxleWks.
Midland Crusher-Pulv. Co.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Co.
Power & Mining Machinery Co.
Traylor Engineering & Mfg. Co.

Jaw Crushers
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Bartlett & Snow Co.
Buchanan Co., C. G.
Chalmers & Williams.
Denver Quartz Mill & Crusher.
International Steam Pump Co.
Johnson Engineering Works.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Works.
Power & Mining Machinery Co.
Traylor Engineering & Mfg. Co.

Jaw Plates
Queen City Foundry Co.

Pebble Mills
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Bartlett & Snow Co.
Chalmers & Williams.
Hardinge Conical Mill Co.
International Steam Pump Co.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Works.
Power & Mining Machinery Co.
Traylor Engineering & Mfg. Co.
Wellman-Seaver-Morgan Co.

Pulverizers
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Bartlett & Snow Co.
Chalmers & Williams.
Denver Quartz Mill & Crusher.
Hardinge Conical Mill Co.
International Steam Pump Co.
Johnson Engineering Works.
Lehigh Car, Wheel &AxleWks.
Midland Crusher-Pulv. Co.
Moyle Engineering Works.
Power & Mining Machinery Co.
Traylor Engineering & Mfg. Co.

Quartz Mills
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Chalmers & Williams.
Denver Quartz Mill & Crusher.
Hendrie & Bolthoff M. & S. Co.
International Steam Pump Co.
Johnson Engineering Works.
Midland Crusher-Pulv. Co.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Works.
Power & Mining Machinery Co.
Traylor Engineering & Mfg. Co.

Roll-Jaw Crushers
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Chalmers & Williams.
International Steam Pump Co.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Works.
Power & Mining Machinery Co.

Shoes, Dies and Cams
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Works.
Queen City Foundry Co.

Stamps and Accessories
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Chalmers & Williams.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Works.
Traylor Engineering & Mfg. Co.

Stone Crushers and Pulverizers
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Bacon, Earle C.
Chalmers & Williams.
Denver Quartz Mill & Crusher
International Steam Pump Co.
Johnson Engineering Works.
Lehigh Car, Wheel & AxleWks.
Midland Crusher-Pulv. Co.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Co.
Power & Mining Machinery Co
Traylor Engineering & Mfg. Co

Tube Mills and Linings
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Lehigh Car, Wheel &AxleWks.
Morse Bros. Mchy. & Sup. Co.
Queen City Foundry Co.
Traylor Engineering & Mfg. Co
Wellman-Seaver-Morgan Co.

CUPELS
Hell Chemical Co.

CUTTING MACHINES
Channelers
Goodman Manufacturing Co.
Ingersoll-Rand Co.
Morgan-Gardner Electric Co.

Coal Cutters (Rotary)
Goodman Manufacturing Co.
Ingersoll-Rand Co.
Morgan-Gardner Electric Co.

Coal Punchers
Goodman Manufacturing Co.
Ingersoll-Rand Co.
Morgan-Gardner Electric Co.

Tunnelling Machines
Goodman Manufacturing Co.
Ingersoll-Rand Co.
Morgan-Gardner Electric Co.

Continued on Next Page

American Smelting & Refining Co.

—BUYERS OF—

Gold, Silver, Lead, Copper and Zinc Ores.

—PRODUCERS OF—

Gold, Silver, Lead, Copper, Copper Sulphate, Zinc, Zinc Dust, Cadmium, Cadmium Sulphide, Arsenic.

General Office:

34th Floor, EQUITABLE BLDG., 120 Broadway, New York

Four Great Mining Books

Mining Without Timber
By Robert B. Brinsmade
300 pages, illustrated, $3.00 (12 | 6).
The first book on those modern mining methods which require the minimum of timber.
Mr. Brinsmade has collected all the best material which has appeared to date. It covers the various methods of leading mines. It is full and complete on Open Cut, Stoping, Back Caving, Block Caving, Slicing, etc. It discusses also Compressed Air; Principles for Controlling Excavations; Principles of Mine Drainage; Service Shoveling in Open Cuts; Comparison of Various Mining Systems; Principles of Mine Evolution, etc.

Timbering and Mining
By W. H. Storms. *300 pages, illustrated, $2.00 (8 | 6).* Deals with practical methods, not theories, for large and small mines. A straightforward account of the best, safest and most economical methods employed in leading American mines.

Principles of Mining
By H. C. Hoover. *200 pages, illustrated, $2.50 (10 | 6).* The principles of mining as developed by modern science and business methods are here fully discussed under the general headings of Valuation, Organization and Administration.

The Cost of Mining
By James R. Finlay. *415 pages, illustrated, $5.00 (21s).* An economic investigation of the cost of scientific, profitable mining. Detailed analyses cover costs of mining coal, iron, lead, zinc, copper, gold and silver.

For sale by MINING WORLD CO., 1419 Monadnock Block, CHICAGO

United States Smelting Refining & Mining Company
55 Congress Street, Boston, Mass.

United States Metals Refining Company,
Custom Copper Smelter and Electrolytic Copper Refinery at Chrome, N. J.; Custom Electrolytic Lead Refinery, Grasselli, Ind. *Address, 120 Broadway, New York City, N. Y.*

United States Smelting Company,
Custom Lead and Copper Smelter at Midvale, Utah. *Address, Salt Lake City, Utah.*
Custom Zinc Smelters at Altoona, Iola, and La Harpe, Kansas. *Address, 413 Republic Building, Kansas City, Mo.*

Needles Mining & Smelting Company,
Custom Lead and Zinc Concentrator at Needles, Calif. *Address, Needles, Calif.*

Mammoth Copper Mining Company,
Custom Copper Smelter at Kennett, Calif. *Address. Kennett, Calif.*

Goldroad Mines Company,
Custom Cyanide Mill. *Address, Goldroad, Arizona.*

Cia de Real del Monte,
Mines and Mills at Pachuca and Real del Monte, Mexico. *Address, Pachuca, Hidalgo, Mexico.*

United States Smelting, Refining & Mining Exploration Company,
For Examination and Purchase of Metal Mines. *Address, 55 Congress St., Boston, Mass., or 120 Broadway, New York, N. Y.; 1504 Hobart Bldg., San Francisco, Calif.; Newhouse Bldg., Salt Lake City, Utah; 413 Republic Bldg., Kansas City, Mo.; Edificio La Mutua 411 Mexico, D. F.; 906 Mills Bldg., El Paso, Texas.*

Buyers of Ores, Matte and Furnace Products
Refiners of Blister Copper and Lead Bullion
Sellers of Gold, Silver, Lead, Copper, Spelter, Zinc Dust, Arsenic, Selenium and Cadmium

SELLING OFFICE, UNITED STATES SMELTING COMPANY, Inc., 120 Broadway, New York City, N. Y.

International Smelting Company
New York Office: 42 Broadway

Purchasers of **Gold, Silver, Copper, Lead and Antimony Ores**

Smelting Works { International, Utah. Miami, Arizona.
Refineries { Raritan Copper Works, Perth Amboy, N. J. International Lead Refining Co., East Chicago, Indiana.
Ore Purchasing Department—618 Kearns Bldg., Salt Lake City, Utah.

Beer, Sondheimer & Co., Inc.
Sole Agents of
NATIONAL ZINC COMPANY
WORKS AT BARTLESVILLE, OKLA. ARGENTINE, KAS., AND SPRINGFIELD, ILL.
Also Sole Agents for
MINERALS SEPARATION AMERICAN SYNDICATE, LTD.
METALS, MATTES, BULLION, ORES
NEW YORK OFFICE, 61 BROADWAY
WESTERN AGENT
H. SALINGER, NEWHOUSE BUILDING, SALT LAKE CITY

CYANIDE EQUIPMENT

Agitators
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Dorr Company, The.
General Filtration Co.
Hammond Iron Works.
Monarch Eng. & Mfg. Co.
Morse Bros. Mchy. & Sup. Co.
Pierce, L. S.
Traylor Engineering & Mfg. Co.

Amalgamators
International Steam Pump Co.
Lane Mill & Mach. Co.
Morse Bros. Mchy. & Sup. Co.
Pierce, L. S.
Power & Mining Machinery Co.
Traylor Engineering & Mfg. Co.

Classifiers
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Deister Machine Co.
Dorr Company, The.
International Steam Pump Co.
Morse Bros. Mchy. & Sup. Co.
Traylor Engineering & Mfg. Co.
Power & Mining Machinery Co.

Cyanide
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Hell Chemical Co.
International Steam Pump Co.
Monarch Eng. & Mfg. Co.
Morse Bros. Mchy. & Sup. Co.
Pierce, L. S.
Power & Mining Machinery Co.
Roessler & Hasslacher Ch. Co.
Traylor Engineering & Mfg. Co.

Dewaterers
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Dorr Company, The.
Traylor Engineering & Mfg. Co.

Distributors
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Moyle Engineering Co.
Traylor Engineering & Mfg. Co

Electro Cyanide Process
Moore Filter Co.

Precipitators (Lime from Filter Leaves)
Moore Filter Co.

Zinc Boxes
Hammond Iron Works.

Zinc Dust Atomizers
Moore Filter Co.

Zinc Dust and Shavings
Hell Chemical Co.
Roessler & Hasslacher Ch. Co.

Zinc Lathes
Chalmers & Williams.
Traylor Engineering & Mfg. Co.
For other Cyanide Equipment see Tanks, Slime-Treating Equipment, Pumps, etc.

DERRICKS (Oil Well)
See Oil Well Supplies.

DETONATORS
See Explosives and Blasting.

DEWATERERS
See Cyanide Equipment.

DIES (Stamp)
See Crushing and Grinding.

DISINTEGRATORS
See Crushing, etc.

DISTRIBUTORS
See Cyanide Equipment.

DRAFTING MATERIAL
See Surveying and Drafting.

DREDGES AND EXCAVATORS

Dredge Accessories
Link-Belt Co.
Marion Steam Shovel Co.
New York Engineering Co.
Union Construction Co.
Wellman-Seaver-Morgan Co.
Yuba Construction Co.

Dredges
Marion Steam Shovel Co.
Morse Bros. Mchy. & Sup. Co.
Union Construction Co.
Wellman-Seaver-Morgan Co.
Yuba Construction Co.

Excavators
Brown Hoisting Machy. Co.
Lidgerwood Mfg. Co.
Link-Belt Co.
Marion Steam Shovel Co.
Morse Bros. Mchy. & Sup. Co.
New York Engineering Co.
Union Construction Co.
Wellman-Seaver-Morgan Co.
Yuba Construction Co.
For other Dredges and Excavators see Buckets, Conveyors and Elevators, Shovels (Power.)

DRILLING AND BORING EQUIPMENT

Cable Drills
Diamond Drill Contracting Co.
Ingersoll-Rand Co.

Carbon and Bortz
Byron & Hall.
Diamond Drill Carbon Co.
Francis & Co.
Levine, Abr.
Standard Diamond Drill Co.

Core Drills
Diamond Drill Contracting Co.
Ingersoll-Rand Co.
McKiernan-Terry Drill Co.
Standard Diamond Drill Co.

Diamond Pointed Drills
Francis & Co.
Hendrie & Bolthoff M. & S. Co.

Drill Sharpeners
Denver Rock Drill Mfg. Co.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.

Drill Steel
Chicago Pneumatic Tool Co.
Denver Rock Drill Mfg. Co.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.
Internat'l High Speed Steel Co.
McKiernan-Terry Drill Co.

Elictric Drills
Denver Rock Drill Mfg. Co.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.

Hammer Drills
Chicago Pneumatic Tool Co.
Denver Rock Drill Mfg. Co.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.
McKiernan-Terry Drill Co.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Works.

Hand Drills
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.
Morse Bros. Mchy. & Sup. Co.
New York Engineering Co.

Prospecting Drills
Diamond Drill Contracting Co.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.
McKiernan-Terry Drill Co.
Morse Bros. Mchy & Sup. Co.
New York Engineering Co.
Standard Diamond Drill Co.

Rock Drills
Chicago Pneumatic Tool Co.
Denver Rock Drill Mfg. Co.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.
McKiernan-Terry Drill Co.
Morse Bros. Mchy. & Sup. Co.
Southwark Fdy. & Mch. Co.
Wood Drill Works.

Stoping Drills
Chicago Pneumatic Tool Co.
Denver Rock Drill Mfg. Co.
Ingersoll-Rand Co.
McKiernan-Terry Drill Co.
Morse Bros. Mchy. & Sup. Co.

Test Drills
Diamond Drill Contracting Co.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Drill Co.
McKiernan-Terry Drill Co.
Standard Diamond Drill Co.
For other Drilling and Boring Equipment see under Oil-Well Supplies and Cutting Machines.

DRIVES (Chain)
Morse Chain Co.

DROP FORGINGS
See Forgings.

DRY CRUSHING MACHINERY
See Crushing and Grinding Equipment.

DRYING APPARATUS

Coal Dryers
Abbé Engineering Co.
Bartlett & Snow Co.
Lehigh Car, Wheel &AxleWks.
Ruggles-Coles Eng. Co.
Traylor Engineering & Mfg. Co.

Evaporators
Bartlett & Snow Co.

Ore Dryers
Abbé Engineering Co.
Bartlett & Snow Co.
Chalmers & Williams.
Lehigh Car, Wheel &AxleWks.
Ruggles-Coles Eng. Co.
Traylor Engineering & Mfg. Co.

DRYING AND HEATING ENGINEERS
Bartlett & Snow Co.
Ruggles-Coles Eng. Co.

DRUMS (Winding)
See Hoisting Equipment.

DUST PROTECTORS
Multi-Metal Separating Screen Co.

DYNAMITE
See Explosives and Blasting.

DYNAMOS
See Electrical Equipment.

DRY CONCENTRATORS
See Concentrators.

ELECTRICAL EQUIPMENT

Alternators
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Batteries
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Controllers
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Convertors
Allis-Chalmers Mfg. Co.
General Electric Co.
Morse Bros. Mchy. & Sup. Co.
Westinghouse Elec. & Mfg. Co.

Dynamos and Generators
Allis-Chalmers Mfg. Co.
General Electric Co.
Hendrie & Bolthoff M. & S. Co.
Morse Bros. Mchy. & Sup. Co.
Westinghouse Elec. & Mfg. Co.

Electric Blasting
See Explosives and Blasting.

Electric Instruments
General Electric Co.
Weston Electric Inst. Co.

Electrical Wire & Cables
American Steel & Wire Co.
General Electric Co.
Roebling's Sons Co., John A.

Ignition Wire
American Steel & Wire Co.
Roebling's Sons Co., John A.

Insulators
Dickinson Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Magnet Wire
American Steel & Wire Co.
Roebling's Sons Co., John A.

Meters
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec. Inst. Co.

Motors
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Rubber Covered Wire
American Steel & Wire Co
Roebling's Sons Co., John A.

Sockets
Dickinson Mfg. Co.

Switchgear
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Transformers
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

ELECTROMAGNETIC SEPARATORS
See Separators.

ELECTROMAGNETS (Lifting)
See Magnets.

ELECTROSTATIC SEPARATORS
See Separators.

ELEVATORS
See Conveyors and Elevators

ENGINES

Compressed Air Engines
Allis-Chalmers Mfg. Co.
Baldwin Locomotive Works.
Chicago Pneumatic Tool Co.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.
Lidgerwood Mfg. Co.
Moore & Co. Engrs., Chas. C.
Morse Bros. Mchy. & Sup. Co.
Nordberg Mfg. Co.
Norwalk Iron Works Co.
Westinghouse Elec. & Mfg. Co.
Wellman-Seaver-Morgan Co.

Electric Hoists
Allis-Chalmers Mfg. Co.
Baldwin Locomotive Works.
Bartlett & Snow Co.
Chicago Pneumatic Tool Co.
English Iron Works Co.
Flory Mfg. Co.
General Electric Co.
Goodman Manufacturing Co.
Hendrie & Bolthoff M. & S. Co.
Lidgerwood Mfg. Co.
Link-Belt Co.
Morgan-Gardner Electric Co.
Morse Bros. Mchy. & Sup. Co.
Nordberg Mfg. Co.
Wellman-Seaver-Morgan Co.
Westinghouse Elec. & Mfg. Co.

Gas, Gasoline and Oil Engines
Allis-Chalmers Mfg. Co.
Bessemer Gas Engine Co.
Chicago Pneumatic Tool Co.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.
International Steam Pump Co.
Lane Mill & Mach. Co.
Morse Bros. Mchy. & Sup. Co.
National Transit Co.
Power & Mining Machinery Co.

Continued on Next Page.

Granby Mining & Smelting Company

Manufacturers of . . .

"GRANBY" Brands Spelter and Pig Lead

Lead Smelter at Granby, Mo. Zinc Smelter at Neodesha, Kan.
Zinc Smelter and Acid Plant at East St. Louis, Ill.

Buyers of high-grade Lead and Zinc Ores

Address: Suite 1710 Third National Bank Bldg., St. Louis, Mo., or Robert W. Conklin, 165 Broadway, New York.

Goldsmith Bros. Smelting & Refining Co.

WORKS: 59th and Throop St., Chicago
OFFICES: Heyworth Bldg.

NEW YORK 20 John Street — SEATTLE Green Building — TORONTO 24 Adelaide St., W.

SMELTERS, REFINERS and BUYERS of
Bullion, Gold, Silver, Lead and Platinum Ores,
Cyanide Slimes and Slags,
Old Amalgamating Plates, Etc.

Address All Correspondence... Heyworth Building, CHICAGO

Sulphate of Copper

in large and small crystals for spot and forward delivery.

PLILIPP BROTHERS
29 Broadway, New York Telephone Rector 2855

The Hegeler Zinc Company

Smelters of **Spelter** and Manufacturers of **Sulphuric Acid**

DANVILLE, ILLINOIS

LIQUID AND GASEOUS FUELS

AND THE PART THEY PLAY IN MODERN POWER PRODUCTION
By Prof. VIVIAN B. LEWES, F. I. C., F. C. S., Prof. of Chemistry, Royal Naval College, Greenwich.

CONTENTS—Lavoisier's Discovery of the Nature of Combustion, etc. The Cycle of Animal and Vegetable Life. Methods of Determining Calorific Value. The Discovery of Petroleum in America. Oil Lamps, etc. The History of Coal Gas. Calorific Value of Coal Gas and its Constituents. The History of Water Gas. Incomplete Combustion. Comparison of the Thermal Values of our Fuels, etc. Appendix. Bibliography. Index. Price, $2.00.

The MINING WORLD, CHICAGO

Sandoval Zinc Co.

410 North Peoria Street .. CHICAGO

Smelters and Refiners

Buyers of Gold, Silver, Zinc, Lead, Copper, Tin, Antimony Ores, Mattes and Residues

Weston

MINIATURE PRECISION
D. C. INSTRUMENTS

The same degree of mechanical and electrical excellence which has won pre-eminence for the larger Weston Models is embodied in these wonderful little masterpieces of the instrument maker's art. The finest watch is a less striking example of perfection in refined workmanship. They are accurate, dead-beat, extremely sensitive. They are shielded against external electrical and magnetic influences. Despite their great refinement in workmanship, they are very substantially constructed and have the longest scale ever provided in instruments of similar size. In short, they are the finest development of small instruments of the pivoted moving coil, permanent magnet type. And the prices are low.

The several models and ranges offer a selection from over 300 different combinations. The Switchboard Instruments are listed in bulletin No. 20 and Portable Instruments in bulletin No. 501. They will be mailed on request.

Weston Electrical Instrument Co.
81 Weston Ave., Newark, N. J.

New York, Boston, Philadelphia, Pittsburgh, Buffalo, Cleveland, Chicago, Cincinnati, St. Louis, Denver, Detroit, Richmond, San Francisco, Toronto, Montreal, Winnipeg, Vancouver

Model 267
Switchboard Type

Chemical Apparatus

Chemicals, Assay and Laboratory Supplies generally.

We have the stock and can make prompt delivery.

Write to us for BORAX GLASS, MOLYBDIC ACID and all kinds of FILTERING PAPER.

Henry Heil Chemical Co.
St. Louis, Mo.

Economical transportation of ore in Alaska.
Direct from mine to barge.

Riblet Tramway Company
HIGH SPEED AUTOMATIC AERIAL TRAMWAYS.
Riblet ALL STEEL Track Cable. Lock Coil Track Cable.
332-34-36 Tramway Bldg., West Sprague, SPOKANE, WASH.

Haulage Engines
Allis-Chalmers Mfg. Co.
Baldwin Locomotive Works.
Flory Mfg. Co.
Goodman Manufacturing Co.
Lidgerwood Mfg. Co.
Link-Belt Co.
Morgan-Gardner Electric Co.
Morse Bros. Mchy. & Sup. Co.
Wellman-Seaver-Morgan Co.
Westinghouse Elec. & Mfg. Co.

Hoisting Engines
Allis-Chalmers Mfg. Co.
Brown Hoisting Mchy. Co.
Danville Fdy. & Mach. Co.
English Iron Works Co.
Flory Mfg. Co.
Hendrie & Bolthoff M. & S. Co.
Lidgerwood Mfg. Co.
Link-Belt Co.
Morse Bros. Mchy. & Sup. Co.
Nordberg Mfg. Co.
Wellman-Seaver-Morgan Co.

Locomotives (Steam)
American Locomotive Co.
Baldwin Locomotive Works.
Morse Bros. Mchy. & Sup. Co.

Steam Engines
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Buckeye Engine Co.
Danville Fdy. & Mach. Co.
English Iron Works Co.
Flory Mfg. Co.
Hendrie & Bolthoff M. & S. Co.
Moore & Co. Engrs., Chas. C.
Morse Bros. Mchy. & Sup. Co.
Lidgerwood Mfg. Co.
Nordberg Mfg. Co.
Vulcan Iron Works.
Wellman-Seaver-Morgan Co.

ENGINEERS AND METALLURGISTS
See Professional Directory.

ENGRAVERS
Wiggins Co., John B.

EVAPORATORS
See Drying Apparatus.

EXCAVATORS
See Dredges and Excavators.

EXHAUST HEADS
See Steam Boilers, etc.

EXPANDED METAL.
North Western Expanded Metal Co.

EXPANDED METAL LATH
North Western Expanded Metal Co.

EXPLOSIVES AND ACCESSORIES

Caps or Detonators
du Pont Powder Co.

Electric Detonators
du Pont Powder Co.

Explosives
du Pont Powder Co.

Fuse Igniters
du Pont Powder Co.

Fuses
du Pont Powder Co.

Tamping Plugs
du Pont Powder Co.

EYE PROTECTION GLASSES
Skinner & Co., M. B.

FANS (Ventilating)
Allis-Chalmers Mfg. Co.

Exhaust Fans
Allis-Chalmers Mfg. Co.
Danville Fdy. & Mach. Co.
General Electric Co.
Monarch Eng. & Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Pressure Fans
Abbé Engineering Co.
Danville Fdy. & Mach. Co.
General Electric Co.
Monarch Eng. & Mfg. Co.
Westinghouse Elec. & Mfg. Co.

FEED APPLIANCES (Boiler)
See Steam Boilers, etc.

FEEDERS (Oil)
See Lubricants, etc.

FEEDERS (Ore)
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Chalmers & Williams.
Hendrie & Bolthoff M. & S. Co.
James Ore Concentrator Co.
Lane Mill & Mach. Co.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Works.
Traylor Engineering & Mfg. Co.
Wellman-Seaver-Morgan Co

FENCING
Carbo Steel Post Co.

FILES AND RASPS
Skinner & Co., M. B.

FILTERS (Ore)
Scaife & Sons Co.

FILTER PRESSES
See Slime-Treating Equipment.

FILTERS (Water)
Scaife & Sons Co.

FIREPROOF MATERIALS
See Asbestos and Insulators

FLANGES
American Spiral Pipe Works.
Lunkenheimer Co.
National Tube Co.

FLEXIBLE COUPLINGS
See Hose and Tubing.

FLINT PEBBLES
Abbé Engineering Co.

FLOTATION OILS
General Naval Stores Co.
Georgia Pine Turpentine Co.
Pensacola Tar & Turpentine Co.

FLOTATION PROCESS
Minerals Sep. Am. Syn., Ltd.

FLUMES
See Hydraulic Mining Equipment.

FORGINGS
American Spiral Pipe Works.
Flory Mfg. Co.
Standard Forgings Co.

FOUNDRY EQUIPMENT
Chicago Pneumatic Tool Co.
Connersville Blower Co.
Ingersoll-Rand Co.
International Steam Pump Co.
Monarch Eng. & Mfg. Co.
Skinner & Co., M. B.
Traylor Engineering & Mfg. Co.
Wellman-Seaver-Morgan Co.

FOUNDRIES (Steel)
Falk Co.
Fawcus Co.
Queen City Foundry Co.
National Transit Co.

FRICTION CLUTCHES
See Clutches.

FROGS AND SWITCHES
Skinner & Co., M. B.

FUEL OILS
Standard Oil Co.

FUEL OIL ENGINES AND COMPRESSORS
See under Engines.

FURNACES AND ACCESSORIES

Assay Furnaces
Hell Chemical Co.
Monarch Eng. & Mfg. Co.

Electric Ovens
General Electric Co.
Hell Chemical Co.

Electric Smelting Furnaces
General Electric Co.
Hell Chemical Co.
Wile Electric Furnace Co.

Melting Furnaces
Monarch Eng. & Mfg. Co.
Wile Electric Furnace Co.

Oil Burning Furnaces
Abbé Engineering Co.
Ingersoll-Rand Co.
Monarch Eng. & Mfg. Co.

Roasting Furnaces
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Morse Bros. Mchy. & Sup. Co.
Queen City Foundry Co.
Traylor Engineering & Mfg. Co.
Wedge Mechanical Furnace Co.
Wile Electric Furnace Co.

Smelting Furnaces
Allis-Chalmers Mfg. Co.
Traylor Engineering & Mfg. Co.
Wedge Mechanical Furnace Co.
Wile Electric Furnace Co.

Tuyeres
Allis-Chalmers Mfg. Co.
Monarch Eng. & Mfg. Co.
Traylor Engineering & Mfg. Co.
For other Furnaces and Accessories see Pocket Smelters, Flues and Stacks, Blowers, Water Jackets, Fireclay and Products, Chemists' Supplies, and Smelting, Roasting and Refining.

FUSE, CAPS, ETC.
See Explosives and Blasting.

GAGE COCKS
See Steam Boilers, etc.

GALVANIZED SHEETS
See Roofing.

GAS BURNERS
See Burners.

GAS ENGINES AND EQUIPMENT
See Engines.

GAS-PRODUCERS
Allis-Chalmers Mfg. Co.
Wellman-Seaver-Morgan Co.
See also Coking Equipment.

GAS PUMPS
Abbé Engineering Co.
Connersville Blower Co.

GASOLINE
See Fuel Oils.

GATE VALVES
See Valves.

GEARS
Robins Conveying Belt. Co.
Bartlett & Snow Co.
Danville Foundry & Mach. Co.
Lehigh Car, Wheel & Axle Wks.
Queen City Foundry Co.
Wellman-Seaver-Morgan Co.

Herringbone (cut)
De Laval Steam Turbine Co.
Falk Co.
Fawcus Co.
National Transit Co.

GENERATING SETS
Allis-Chalmers Mfg. Co.
General Electric Co.

GENERATORS
See Electrical Equipment.

GIANTS (Hydraulic)
See Hydraulic Mining Equipment.

GOVERNORS (Engine)
Allis-Chalmers Mfg. Co.
Wellman-Seaver-Morgan Co.

GRAPHITE PRODUCTS
Dixon Crucible Co.

GREASE AND ACCESSORIES
See Lubricants, etc.

GRIZZLIES
See Screens.

HEATERS (Feed-Water)
See Steam Boilers, etc.

HOISTING CHAINS
Taylor Chain Co.

HOISTING EQUIPMENT

Brakes (Hoisting)
Allis-Chalmers Mfg. Co.
Danville Foundry & Mach. Co.
Lidgerwood Mfg. Co.
Wellman-Seaver-Morgan Co.
Westinghouse Elec. & Mfg. Co.

Cables
See Wire Rope and Cables.

Electric Hoists
See under Engines.

Engines
See under Engines.

Head Frames and Head Gear
Bartlett & Snow Co.

Hoisting Engines
See under Engines.

Indicators
Allis-Chalmers Mfg. Co.
Danville Foundry & Mach. Co
Lidgerwood Mfg. Co.
Wellman-Seaver-Morgan Co.

Overwinding Equipment
Allis-Chalmers Mfg. Co.
Danville Foundry & Mach. Co.
Wellman-Seaver-Morgan Co.

Pulleys and Rollers
Allis-Chalmers Mfg. Co.
Flory Mfg. Co.

Skips and Cages
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Brown Hoisting Machy. Co.
Chalmers & Williams.
Danville Foundry & Mach. Co.
Hendrie & Bolthoff M. & S. Co.
Lidgerwood Mfg. Co.
Traylor Engineering & Mfg. Co.
Wellman-Seaver-Morgan Co.
For other Hoisting Equipment see under Buckets, Cranes, Derricks, Drums, and Clips and Couplings.

HOPPERS, BINS AND POCKETS
Bartlett & Snow Co.
Link-Belt Co.

HOSE AND TUBING

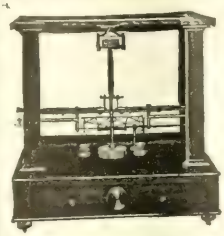
Air Piping and Tubing
Chicago Pneumatic Tool Co
Goodrich Co., The B. F.
Hendrie & Bolthoff M. & S. Co
Ingersoll-Rand Co.
Norwalk Iron Works Co.

Couplings, Flexible
Connersville Blower Co.

Hose Couplers
Chicago Pneumatic Tool Co.
Goodrich Co., The B. F.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.
McKiernan-Terry Drill Co.
Norwalk Iron Works Co.

Continued on Next Page.

Thompson's Balances



will satisfy the most exacting demands. Their constancy is in keeping with the extreme care required for accurate work.

You Can Buy Them Direct from the Factory.

To avoid inaccurate weights always use our Multiple Rider Attachment.

Thompson Balance Co., Denver, Colo.

The Roessler & Hasslacher Chemical Co.

100 William Street NEW YORK

Cyanide
73-76%
Cyanogen content 39-40%

Cyanide of Sodium
96-98%
Cyanogen content 51-52%

DIXON'S Waterproof Graphite GREASE

Is of a dense consistency, and of adhesive nature, suitable for general heavy service at slow speeds and heavy pressures.

Booklet No. 147-W tells about it.

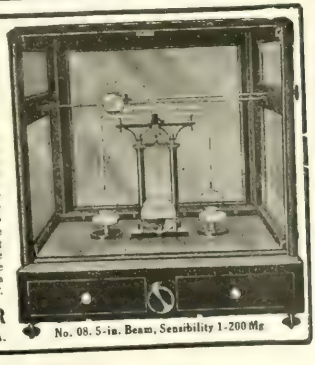
Made in JERSEY CITY, N. J., by the
JOSEPH DIXON CRUCIBLE COMPANY
Established 1827.

DORR CLASSIFIERS, THICKENERS AGITATORS
Write for Catalog and Data
THE DORR COMPANY (*Engineers*)
SUCCESSOR TO THE DORR CYANIDE MACHINERY COMPANY
1009 17th Street, Denver, Colo. Cable address "Dorr"
17 Battery Place, New York City, N. Y. Cable Address "Dorrclass"
16 South Street, London, England Cable Address "Cyandormac"
Code: Bedford McNeill and Western Union
Grothe & Carter, Mexico City, General Agents for Mexico.
N. Guthridge, Ltd., Sydney, General Agents for Australia.

1840 *The* 1915
Standard of Excellence
TROEMNER'S ASSAY BALANCES

Insurance saves worry over possibilities. Troemner Precision Balances insure all your work of investigation where the correct weight is the desideratum. They are right—will stay right—you will be right. They have been right for the past 75 years—then why let someone talk you into buying something on which more money is made by someone. Remember you're insured to be correct in using a Troemner. *Write for catalog.*

HENRY TROEMNER
PHILADELPHIA, PA., U. S. A.



No. 08. 5-in. Beam, Sensibility 1-200 Mg

Undisputedly The Best—

THE "DICKBELT"

Has clearly proven all over the world its pronounced superiority for

HARD SERVICES
HIGH SPEEDS
WET OR DRY PLACES

Transmission—Conveying—Elevating

R. & J. Dick, Ltd. : Passaic, N. J.

Branches and Agents Everywhere.

WEBER Reinforced Concrete CHIMNEYS

HUNDREDS IN USE

Weber Coniform Chimney

Height, 216' 0". Inside diameter, 12' 0". Built for Miami Copper Co., at Miami, Ariz.

Catalog and specifications without charge.

The Weber Chimney Company
333 S. Michigan Ave., Chicago, Ill.

Magnesite
Manganese
Molybdenite and
Tungsten

These ores now are being mined in the Southwest and California to replace those secured from abroad before the war.

Richest deposits of these, as well as of copper, gold, silver, zinc and other minerals, await the coming of prospector, miner, and capitalist.

For information address

C. C. DANA
Industrial Commissioner
A. T. & S. F. Ry. System,
Chicago

Santa Fe
All the way

Rubber Hose
Chicago Pneumatic Tool Co.
Goodrich Co., The B. F.
Gutta Percha & Rubber Mfg. Co.

Steam and Air Hose
Chicago Pneumatic Tool Co.
Goodrich Co., The B. F.
Hendrie & Bolthoff M. & S. Co.
Ingersoll-Rand Co.
For other Hose and Tubing see under Piping and Accessories.

HORSE SHOES AND CALKS
Skinner & Co., M. B.

HOTELS
Brown Palace, Denver.
Hotel McAlpin, New York.
Kaiserhof Hotel, Chicago.
Newhouse Hotel, Salt Lake.

HYDRANTS
Skinner & Co., M. B.

HYDRAULIC MINING EQUIPMENT

Giants or Monitors
Allis-Chalmers Mfg. Co.
American Spiral Pipe Works.
Hendrie & Bolthoff M. & S. Co.
Moyle Engineering Co.
National Transit Co.
New York Engineering Co.
Pelton Water Wheel Co.
Southwark Fdy. & Mch. Co.

Spiral Riveted Pipe
American Spiral Pipe Works.

Steel Flumes
Allis-Chalmers Mfg. Co.
American Spiral Pipe Works.
Hammond Iron Works.
Moyle Engineering Co.
National Transit Co.
New York Engineering Co.
Southwark Fdy. & Mch. Co.
Standard Spiral Pipe Works.

Water Meters
International Steam Pump Co.
New York Engineering Co.
Prescott Steam Pump Co.
Worthington, Henry R.
Pelton Water Wheel Co.

Wood-Stave Flumes and Pipes
New York Engineering Co.
Redwood Manufacturing Co.
For other Hydraulic Equipment see under Dredges and Piping and Accessories.

INDICATORS
See Hoisting Equipment.

INJECTORS
See Steam Boilers, etc.

INSTRUMENTS

Assayers'
See Chemists' Supplies.

Drawing and Surveying
See Surveying and Drafting Equipment.

INSULATORS (Heat)
See Asbestos Products, etc.

INSULATORS (Electric)
See Electrical Equipment.

IRON BRIQUETTERS
See Briquetting Machinery.

IRON AND STEEL
See Structural Steel and Iron.

JAW CRUSHERS
See Crushing and Grinding Equipment.

JAW PLATES
See Crushing and Grinding Equipment.

JIGS
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Chalmers & Williams.
International Steam Pump Co.
James Ore Concentrator Co.
Morse Bros. Mchy. & Sup. Co.
Power & Mining Machinery Co.
Traylor Engineering & Mfg. Co.

LABORATORIES
See Chemists' Supplies.

LAMPS
See Lighting Equipment.

LADLE LINERS
See Smelting, Refining, etc.

LATHES
Skinner & Co., M. B.

LEVELS AND RULES
See Surveying and Drafting.

LIGHTING EQUIPMENT

Candlesticks
Skinner & Co., M. B.

Carbide Lamps
Skinner & Co., M. B.
Wolf Safety Lamp Co.

Electric Lamps (Arc)
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Electric Lamps (Incandescent)
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Miners' Lamps
General Electric Co.
Skinner & Co., M. B.
Wolf Safety Lamp Co.

Safety Lamps (Fuel)
Heil Chemical Co.

LIME MACHINERY
See Cement and Concrete Machinery.

LINK BELTING
See Belting.

LITERATURE (Mining, etc.)
See Books and Literature.

LOCKERS
Skinner & Co., M. B.

LOCOMOTIVES AND HAULAGE ENGINES
American Locomotive Co.
Atlas Car & Mfg. Co.
Brown Hoisting Machy. Co.
General Electric Co.
Goodman Mfg. Co.
Link-Belt Co.
Morgan-Gardner Electric Co.
Westinghouse Elec. & Mfg. Co.

LUBRICANTS AND ACCESSORIES

Graphite Lubricators
Dixon Crucible Co.
Lunkenheimer Co.
Wm. Powell Co.

Grease Cups
Albany Lubricating Co.
Keystone Lubricating Co.
Lunkenheimer Co.
Wm. Powell Co.

Greases and Oils
Albany Lubricating Co.
Keystone Lubricating Co.

Oil Cups
Albany Lubricating Co.
Lunkenheimer Co.
Wm. Powell Co.

Oilers
Lunkenheimer Co.
Wm. Powell Co.

Sight Feeders
Lunkenheimer Co.
Wm. Powell Co.

Wire Rope Greasers
Broderick & Bascom Rope Co.

MACHINERY (Second-Hand)
Atlas Car & Mfg. Co.
Chicago House Wrecking Co.
Morse Bros. Mchy. Co.

MAGNETIC SEPARATORS
See Separators.

MAGNETS (Lifting)
Hell Chemical Co.

MERCURY
Hell Chemical Co.
Lane Mill & Mach. Co.
Pierce, L. S.

METAL BUYERS
Am. Zinc Lead & Sm. Co.
Beer, Sondheimer & Co.
Bolivian D. & Ex. Co.
Goldsmith Bros. S. & R. Co.
Granby Mining & Sm. Co.
Hegeler Zinc Co.
International Smelting Co.
Metals Buying & Ref. Co.
Metals Recovery, Inc.
Phillip Brothers.
Primos Chemical Co.
U. S. Smelting R. & M. Co.

METAL CHECKS
Skinner & Co., M. B.

METAL LATH
North Western Expanded Metal Co.

METALLURGICAL EQUIPMENT
See Furnaces and Accessories, Smelting, Refining, etc., and Chemists' Supplies.

METERS (Electric)
See Electrical Equipment.

METERS (Water)
See Hydraulic Mining Equipment.

MINE LAMPS
See under Lighting Equipment.

MINE TELEPHONES
See Telephones.

MONITORS
See Hydraulic Mining.

MOTOR TRUCKS
Jeffery Co., Thos. B.
Morse Bros. Mchy. & Sup. Co.

NAILS, SPIKES, ETC.
American Steel & Wire Co.

OIL BURNERS
See Burners.

OIL CUPS, ETC.
See Lubricants and Accessories.

OILS (Flotation)
General Naval Stores Co.
Georgia Pine Turpentine Co.
Pensacola Tar & Turpentine Co.

OIL FUEL (Engine and Furnace)
See Fuel Oils.

OIL FUELS (Lamp)
See Lighting Equipment.

OIL WELL SUPPLIES
See under Drilling and Boring, Piping and Accessories, Tanks, Pumps, Ropage and Cables.

ORE BINS
See Hoppers, Bins and Pockets.

ORE DRIERS
See Drying Apparatus.

ORE WASHERS
See Washeries.

OVENS (Drying)
See Drying Apparatus.

OVENS (Roasting)
See Furnaces (Roasting).

OXY-ACETYLENE APPARATUS
Imperial Brass Mfg. Co.
K-G. Welding & Cutting Co.,
Skinner & Co., M. B.

PACKING AND PIPE COVERING
See Asbestos and Insulators.

PANS

Amalgamating
Allis-Chalmers Mfg. Co.
Moyle Engineering Works.
Traylor Engineering & Mfg. Co.

Roasting
Traylor Engineering & Mfg. Co.

PEBBLES (Grinding)
See Crushing and Grinding Equipment.

PERFORATED METAL SIEVES, ETC.

Perforated Metal
Allis-Chalmers Mfg. Co.
Chicago Perforating Co.

Sieves
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Buffalo Wire Works Co.
Chalmers & Williams.
Chicago Perforating Co.
Multi-Metal Separating Screen Co.

Wire Mesh and Gauze
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Buffalo Wire Works Co.
Chalmers & Williams.
Multi-Metal Separating Screen Co.

PIPE COVERING
See Asbestos and Insulators.

PIPING AND ACCESSORIES

Pipe Cutters
Armstrong Mfg. Co.

Pipe (Cast Iron)
American Cast Iron Pipe Co.
Clow & Sons, James B.
Donaldson Iron Co.
Glamorgan Pipe & Fdy. Co.
Lynchburg Foundry Co.
Massillon Iron & Steel Co.
U. S. Cast Iron Pipe & Fdy. Co.

Pipe Clamps
National Tube Co.
Skinner & Co., M. B.

Pipe Fittings
American Spiral Pipe Works.
Lunkenheimer Co.
National Transit Co.
National Tube Co.
[illegible]
Standard Spiral Pipe Works.

Pipe (Riveted)
[illegible] Works.
[illegible]
Standard Spiral Pipe Works.

Continued on Next Page.

Roebling **Wire Rope**

STANDARD FOR

Mining, Logging, Dredging, Construction, Tramways, Cableways, Incline Haulage, Ferries and all other purposes

The wire rope of maximum service

JOHN A. ROEBLING'S SONS COMPANY
Trenton, New Jersey

A Modern Miracle In Cards

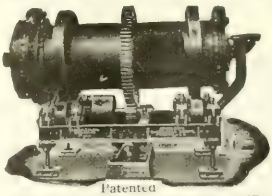
Peerless Patent Book Form Cards are bound in books containing 25 cards each and are carried in a genuine seal leather case. When a card is presented it is detached from the book and there **isn't the slightest indication of a rough edge. Send for a sample tab and try it yourself.**

Our Smart Card Case

You know the advantages of having your cards always clean, perfectly flat, unmarred and always together. There is no embarrassing search through all your pockets only to dig up a soiled, rumpled card. **Peerless Patent Book Form Cards** pull your hand right to the case. Handsomely engraved, they prove you are an up-to-date man with whom quality counts. *Write for samples, now.*

THE JOHN B. WIGGINS COMPANY
Sole Manufacturers
Engravers — Die Embossers — Plate Printers
81-82 EAST ADAMS ST., CHICAGO

MARATHON MILL



Patented

GUARANTEED TO BEAT ALL OTHERS. Really grinds twice as much coarse to four times as much fine, depending on conditions. ¼ Inch to 200 Mesh Discharges.

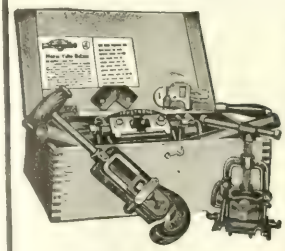
NEW GOLD SAVING HEADS.

Guaranteed to beat all others saving gold inside the mill.

Write for grinding tests and particulars.

ROCK CRUSHERS, MINING AND MILLING MACHINERY

JOHNSON ENGINEERING WORKS
FIRST NATIONAL BANK BUILDING, CHICAGO, U. S. A.



Armstrong COMBINATION PIPE KIT

1 No. 2 Stock
¼ to 1" Dies
1 Pipe Cutter
1 Hinged Vise
1 Pipe Wrench

MANUFACTURED BY

THE ARMSTRONG MFG. CO.
324 Knowlton St., BRIDGEPORT, CONN.

ABBÉ TUBE MILLS WITH PATENTED "IDEAL" SPIRAL FEEDER
Abbé Tire Style Tube Mill. Patented
Also Pebble Mills, Ball Mills, Laboratory Mills, Vacuum Pumps, Pressure Blowers
Send for Catalogs
ABBÉ ENGINEERING CO., 222-224 Broadway, NEW YORK

Look For A STORY IN PICTURES.
NATIONAL
The Name
¶ "Once upon a time" the only way a story could be written was in pictures, and it is one of the most effective even in this age of literature.
¶ See the story of uses of "NATIONAL" Pipe for mine service told in pictures on the front cover of the June 17th issue.
NATIONAL TUBE COMPANY, Pittsburgh, Pa.

ROBINS CONVEYING MACHINERY
Our bulletin describes the successful solution of many materials-handling problems. Let them help you.
ROBINS CONVEYING BELT COMPANY
New York, 22 Park Row Chicago, Old Colony Building
San Francisco, The Griffin Co. Toronto, Gutta Percha & Rubber, Ltd.
London, E. C., Fraser & Chalmers, Ltd.

SEND FOR CATALOGUE OF
FARREL ORE & ROCK CRUSHER
FARREL FOUNDRY AND MACHINE COMPANY
EARLE C. BACON ENGINEER HAVEMEYER BUILDING — NEW YORK —

ROBT. HOLMES & BROTHERS, Inc., Successors to
Danville Foundry & Machine Co. DANVILLE, ILLINOIS.
The consolidation of these two large plants means the manufacture of a more varied and extensive line of mining and other machinery, doubling the facilities of the works.

PELTON
-DODLE CENTRIFUGAL PUMPS
THE PELTON WATER WHEEL CO
2227 Harrison St. — 95 West St
SAN FRANCISCO — NEW YORK

WATER SOFTENING OR FILTRATION
FOR BOILER FEED AND ALL INDUSTRIAL USES

BUCHANAN All-Steel CRUSHERS
Crushing Rolls
Magnetic Separators
Crushing Plants complete in all details from 100 to 5,000 tons daily capacity.
C. G. Buchanan Co., Inc.,
Main Office: 90 West St., New York
Branch: 1218 Chestnut St., Philadelphia, Pa.

Pipe (Steel)
American Spiral Pipe Works.
National Tube Co.

Pipe Threaders
Armstrong Mfg. Co.

Pipe (Welded)
American Spiral Pipe Works.
National Tube Co.
Standard Spiral Pipe Works.

Pipe (Wooden)
Redwood Manufacturers Co.
For other Piping and Accessories see under Valves, Oil-Well Supplies, Hose and Tubing, and Asbestos and Insulators.

PISTONS
Allis-Chalmers Mfg. Co.
Wellman-Seaver-Morgan Co.

PLACER MACHINES
Pierce, L. S.

PLATES (Amalgamating)
See Amalgamating Equipment.

PLATES (Iron and Steel)
See Structural Steel.

PNEUMATIC TOOLS
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

POSTS
Carbo Steel Post Co.

POWDER (Blasting)
See Explosives.

POWER TRANSMISSION
Morse Chain Co.

PRECIPITATORS
See Cyanide Equipment.

PROSPECTORS' OUTFIT
Moyle Engineering Works.
See also Pans.

PULLEYS AND ROLLERS
Dodge Sales & Eng. Co.
Flory Mfg. Co.
Lane Mill & Mach. Co.
Queen City Foundry Co.
Robins Conveying Belt. Co.
Wellman-Seaver-Morgan Co.

PULVERIZERS
See Crushing and Grinding.

PUMPS

Centrifugal
Aldrich Pump Co.
Allis-Chalmers Mfg. Co.
Cameron Steam Pump Works.
Crucible Steel Co.
De Laval Steam Turbine Co.
Goulds Mfg. Co.
Hendrie & Bolthoff M. & S. Co.
International Steam Pump Co.
Moore & Co. Engrs., Chas. C.
Pelton Water Wheel Co.
Prescott Steam Pump Co.
Southwark Fdy. & Mch. Co.
Worthington, Henry R.

Electrical
Aldrich Pump Co.
Allis-Chalmers Mfg. Co.
Cameron Steam Pump Works.
Deane Steam Pump Works Co.
Epping-Carpenter Pump Co.
Goulds Mfg. Co.
International Steam Pump Co.
Monarch Eng. & Mfg. Co.
Prescott Steam Pump Co.

Oil Pumps
Blake & Knowles Steam Pump Co.
Connersville Blower Co.
International Steam Pump Co.
Lunkenheimer Co.
National Transit Co.
Monarch Eng. & Mfg. Co.
Moore & Co. Engrs., Chas. C.
Prescott Steam Pump Co.
Snow Steam Pump Co.
Worthington, Henry R.

Pneumatic
Cameron Steam Pump Works.
International Steam Pump Co.
Laidlaw-Dunn-Gordon Co.
Prescott Steam Pump Co.

Rotary
Abbé Engineering Co.
Aldrich Pump Co.
Allis-Chalmers Mfg. Co.
Cameron Steam Pump Works.
Connersville Blower Co.
Frenier & Son.
Goulds Mfg. Co.
International Steam Pump Co.
Monarch Eng. & Mfg. Co.
Prescott Steam Pump Co.
Worthington, Henry R.

Sand
Abbé Engineering Co.
Aldrich Pump Co.
Allis-Chalmers Mfg. Co.
Goulds Mfg. Co.
International Steam Pump Co.
Prescott Steam Pump Co.
Worthington, Henry R.

Sinking
Aldrich Pump Co.
Allis-Chalmers Mfg. Co.
Blake & Knowles Steam Pump Co.
Cameron Steam Pump Works.
Crucible Steel Co.
Danville Foundry & Mch. Co.
Goulds Mfg. Co.
International Steam Pump Co.
Moore & Co. Engrs., Chas. C.
Moyle Engineering Co.
Prescott Steam Pump Co.

Slime and Injection Pumps
Allis-Chalmers Mfg. Co.
Goulds Mfg. Co.

Spiral
Abbé Engineering Co.
Frenier & Son.

Turbine
Aldrich Pump Co.
Allis-Chalmers Mfg. Co.
Cameron Steam Pump Works
De Laval Steam Turbine Co.
General Electric Co.
Goulds Mfg. Co.
Ingersoll-Rand Co.
International Steam Pump Co.
Moore & Co. Engrs., Chas. C.
Pelton Water Wheel Co.
Prescott Steam Pump Co
Southwark Fdy. & Mch. Co.
Worthington, Henry R.

Vacuum
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Blake & Knowles Steam Pump Co.
Cameron Steam Pump Works
Connersville Blower Co.
Deane Steam Pump Works Co.
Goulds Mfg. Co.
Ingersoll-Rand Co.
International Steam Pump Co
Prescott Steam Pump Co.
Roots Co., P. H. & F. M.
Worthington, Henry R.

PUNCHERS (Coal)
See Cutting Machines.

PYROMETERS
Skinner & Co., M. B.

QUARRYING MACHINERY
See Cutting Machines, Drills etc., Explosives, and Blasting Equipment, Pumps Transport and Handling Equipment, etc.

QUARTZ MILLS
See Crushing and Grinding.

QUICKSILVER
See Mercury.

REFINING MACHINERY (Oil)
Hammond Iron Works.

RAILROADS
Santa Fe Railroad.

RARE MINERAL DEALERS
Crucible Steel Co.
Earl, E. P.
Primos Chemical Co.
Scott, Geo. S.

RATCHET DRILLS
Skinner & Co., M. B.

RECEIVERS (Air)
Norwalk Iron Works Co.

REFINERIES AND SMELTERS
American Sm. & Ref. Co.
Am. Zinc Lead & Sm. Co.
Beer, Sondheimer & Co.
Goldsmith Bros. S. & R. Co.
Granby M. & S. Co.
Hegeler Zinc Co.
International Sm. & Ref. Co.
Metals Buying & Ref. Co.
Sandoval Zinc Co.
U. S. Sm., Ref. & Mg. Co.

REFINING EQUIPMENT
See Smelting Equipment.

RESCUE APPARATUS
Elmer, H. N.
Siebe, Gorman & Co.

RESPIRATORS
Multi-Metal Separating Screen Co.

RIFFLES (Table)
General Ore Concentrating Co.

RINGS AND DIES
Chalmers & Williams.
Lehigh Car, Wheel &AxleWks.
Traylor Engrng. & Mfg. Co.
Wellman-Seaver-Morgan Co.

RIVETING MACHINES
Skinner & Co., M. B

ROASTERS
See Roasting Furnaces, under Furnaces and Accessories.

ROCK CRUSHERS, ETC.
See Crushing and Grinding Equipment.

ROCK DRILLS
See Drilling and Boring Equipment.

ROLL CRUSHERS
See Crushing and Grinding Equipment.

ROLLER BEARINGS
Hyatt Roller Bearing Co.

ROOFING
Galvanized Sheets
American Sheet & Tin Plate Co.

SAFETY DEVICES
Hoisting
Balliet Engineering Co

SAFETY HOOKS AND LINKS
See Clips and Couplings.

SAFETY LAMPS
See Lighting Equipment.

SAMPLING WORKS
Beer, Sondheimer & Co.
Granby M. & S. Co.
International Sm. & Ref. Co
Metals Buying & Ref. Co.
U. S. Sm., Ref. & Mg. Co.

SAWMILL MACHINERY
Allis-Chalmers Co
Link-Belt Co.

SAWS
Skinner & Co., M. B.

SCALES
Merrick Scale Mfg. Co.

SCREENS
Grizzlies
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Buchanan Co., C. G.
Buffalo Wire Works Co.
Chalmers & Williams.
Chicago Perforating Co.
Lane Mill & Mach. Co.
Morse Bros. Mchy. & Sup. Co.
Multi-Metal Separating Screen Co.
Traylor Engrng. & Mfg. Co.
Wellman-Seaver-Morgan Co.

Revolving Screens
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Buchanan Co., C. G.
Buffalo Wire Works Co.
Chalmers & Williams.
Chicago Perforating Co.
International Steam Pump Co.
James Ore Concentrator Co.
Lane Mill & Mach. Co.
Link-Belt Co.
Morse Bros. Mchy. & Sup. Co.
Moyle Engineering Co.
Multi-Metal Separating Screen Co.
Power & Mining Mach. Co.
Traylor Engrng. & Mfg. Co.
Wellman-Seaver-Morgan Co.
For other Screens see under Perforated Metal, Trommels and Coking Equipment.

SCREW CONVEYORS
See Conveyors and Elevators.

SECOND-HAND MACHINERY
See Machinery (Second-hand)

SEPARATORS
Electrostatic
Am. Zinc Ore Separating Co.
Buchanan Co., C. G.
Dings Electro-Magnetic Separator Co.
James Ore Concentrator Co.

SHAFTING
Allis-Chalmers Mfg. Co.
American Steel & Wire Co.
Bartlett & Snow Co.
Chalmers & Williams.
Standard Forgings Co.

SHEAVES
Allis-Chalmers Mfg. Co.
American Spiral Pipe Works.
Bartlett & Snow Co.
Danville Foundry & Mch. Co.
Link-Belt Co.
Moyle Engineering Co.
Robins Conveying Belt. Co.
Traylor Engrng. & Mfg. Co.

SHEETS (Iron and Steel)
Amer. Sheet & Tin Plate Co.

SHELLS AND RINGS
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Chalmers & Williams.
Lehigh Car, Wheel & AxleWks
Standard Steel Works
Traylor Engrng. & Mfg. Co.

SHOES, DIES, CAMS
See Crushing and Grinding Equipment

SHOT FIRERS
See Explosives and Accessories.

SINTERING
Dwight & Lloyd Sintering Co

SLIME-TREATING EQUIPMENT
Classifiers
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Deister Machine Co.
Dorr Company, The
James Ore Concentrator Co.
Morse Bros. Mchy. & Sup. Co.
Traylor Engrng. & Mfg. Co.

Dewaterers
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Dorr Company, The
Traylor Engrng. & Mfg. Co.

Filters
Allis-Chalmers Mfg. Co.
Chalmers & Williams
General Filtration Co
Traylor Engrng. & Mfg. Co.

Continued on Next Page.

New Kaiserhof
HOTEL—CAFE
CLARK STREET
Near Jackson Blvd.
CHICAGO
450 Modern Rooms $1.00 Per Day up | 300 with Bath $2.00 Per Day up
FINEST GERMAN RESTAURANT
ROESSLER & TEICH

HOTEL McALPIN
BROADWAY AND 34th St.
NEW YORK
¶ An hotel of the highest class specially adapted to the needs of the business man. Every innovation of service—stock quotation board, broker's office.
¶ Most convenient and accessible in the city—one block from Pennsylvania Terminal and a short distance from Grand Central Station,
¶ Excellent cuisine, distinctive accommodations, perfect service—at notably moderate prices.
Management : L. M. BOOMER

The Brown Palace Hotel
Denver, Colorado
ABSOLUTELY FIRE-PROOF

STRICTLY FIRST CLASS
C. H. MORSE, Manager

—THE—
Newhouse Hotel
SALT LAKE CITY, UTAH
400 Rooms, Each Room with Bath.
Rates $1.50 and up. Absolutely first-class.
F. W. PAGET
Manager

For What Does Your "E. M." Stand?

If you limit the scope of your brain by your slide-rule, and believe that you have done ALL your duty to the world when your assays and smelter returns check up at something above costs, you may hole through to your pay check without accusation of not being on the level, BUT—

did you ever stop to consider that for the highest type of professional man there waits work of higher potentiality than that whose rules he crammed to get his sheepskin?

What are you doing As A Mining Engineer for the mines and engineers of the future?

The greatest difficulty before our business today lies in the exaggerated promises of stock selling campaigns. The small investor collectively furnishes the means for most engineering work, yet he can not individually obtain unbiased facts in regard to the properties he is asked to help. If you will give me your co-operation in building up a news service which I trust will eventually be placed under the supervision of higher technical authority than mine, fill out and send me the following blank:

ARTHUR PRILL, 110 West 40th St., New York:

You may call on me for information about mining properties in the following districts .....

.....

.....

.....

When the news you seek is readily accessible to me and its dissemination is compatible with the interest of my clients, I will answer a reasonable number of questions on a blank so arranged that my work shall usually be limited to entering a "yes" or "no," or filling in a figure; blank and stamped, addressed envelope to be furnished by you. My name is never to be used without my express permission; the blank will require no signature as its connection with me will be known to you by a number. This agreement is revocable by myself without notice.

Name.....

Address .....

I am compelled to decline advertising or promotion of mining ventures, although on receipt of some letters my heart yearns to help the poor devil eating sow belly and beans while pegging away in the hills. The public has not yet been trained to see its own interest in supporting a news service that sticks to facts. Hence I cover its expense by a commission brokerage business whose records are open to any engineering society or journal.

A part of your own investment business and that of your friends is respectfully invited. I will buy or sell for you any stock or bond on any exchange at the regular commission rate of that exchange.

ARTHUR PRILL

Securities

110 West 40th Street : New York

Telephone Bryant 8093

Filter Presses
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
International Steam Pump Co.
Power & Mining Machinery Co.
Queen City Foundry Co.
Traylor Engrng. & Mfg. Co.

Tables
Deister Machine Co.
Hendrie & Bolthoff M. & S. Co.
James Ore Concentrator Co.
Morse Bros. Mchy. & Sup. Co.
Senn Concentrator Co.
Traylor Engrng. & Mfg. Co.

Thickeners
Chalmers & Williams.
Dorr Company, The.
Morse Bros. Mchy. & Sup. Co.
Traylor Engrng. & Mfg. Co.
For other Slime-Treating Equipment see under Cyanide Equipment.

SMELTERS (Custom)
See Refiners and Smelters.

SMELTING, ROASTING AND REFINING EQUIPMENT

Furnaces and Accessories
Allis-Chalmers Mfg. Co.
Dwight & Lloyd Sintering Co.
Monarch Eng. & Mfg. Co.
Morse Bros. Mchy. & Sup. Co.
Traylor Engrng. & Mfg. Co.
Wedge Mechanical Furnace Co.
Wile Electric Furnace Co.

Ladle Liners
Monarch Eng. & Mfg. Co.
For other Smelting, Roasting and Refining Equipment see under Burners, Converters and Cupels.

SPRAYERS (Mine)
Ingersoll-Rand Co.

SPRINGS (Coiled and Flat)
Gibson & Co., Wm. D.

STAMPS AND ACCESSORIES
See Crushing and Grinding Equipment.

STEAM BOILERS AND ACCESSORIES

Boiler Feeders
Lunkenheimer Co.
Morse Bros. Mchy. & Sup. Co.

Boiler Compound
Mining Agencies, Ltd.

Boiler Fronts and Doors
Queen City Foundry Co.

Boilers
Almy Water Tube Boiler Co.
Moore & Co. Engrs., Chas. C.
Morse Bros. Mchy. & Sup. Co.
Queen City Foundry Co.

Condensers
Allis-Chalmers Mfg. Co.
Deane Steam Pump Works.
International Steam Pump Co.
Moore & Co. Engrs., Chas. C.
Nordberg Mfg. Co.

Exhausters and Heads
American Spiral Pipe Works.

Gages and Cocks
Jenkins Bros.
Lunkenheimer Co.
National Tube Co.
Wm. Powell Co.

Heaters (Feed Water)
International Steam Pump Co.
Blake & Knowles Steam Pump Co.

Injectors
Jenkins Bros.
Lunkenheimer Co.
Wm. Powell Co.

Steam Fittings
Lunkenheimer Co.
Morse Bros. Mchy. & Sup. Co.
National Tube Co.
Wm. Powell Co.

Steam Specialties
Jenkins Bros.
Lunkenheimer Co.
National Tube Co.
Skinner & Co., M. B.
Wm. Powell Co.

Steam Traps
Jenkins Bros.
Morse Bros. Mchy. & Sup. Co.
National Tube Co.
Skinner & Co., M. B.
Wm. Powell Co.
For other Steam Accessories see under Governors, Hose and Tubing, Piping and Accessories, Asbestos and Insulators and Turbines.

STEAM HOISTS
See Hoisting Equipment.

STEAM SHOVELS
See Shovels.

STEEL (Drill Steel)
See Drilling and Boring Equipment.

STEEL POSTS
See Posts.

STEEL (Structural)
See Structural Steel.

STEEL FLUMES
See Hydraulic Mining Equipment.

STOCKS AND DIES
Armstrong Mfg. Co.

STONE CRUSHERS
See Crushing and Grinding Equipment.

STRUCTURAL STEEL AND IRON

Angles
American Bridge Co.
Robins Conveying Belt Co.

Bars
American Bridge Co.

Beams
American Bridge Co.
Robins Conveying Belt Co.

Corner Plates
American Bridge Co.
Robins Conveying Belt Co.

Girders
American Bridge Co.
Robins Conveying Belt Co.

TANKS

Cyanide
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Hammond Iron Works.
Moyle Engineering Co.
Redwood Mfrs. Co.

Oil
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Hammond Iron Works.
Monarch Eng. & Mfg. Co.
Redwood Mfrs. Co.

Water
Chalmers & Williams.
Hammond Iron Works.
Redwood Mfrs. Co.

Wooden
Chalmers & Williams.

TAPES (Measuring)
See Surveying Equipment.

TAPPETS (Stamp-Mill)
See Crushing and Grinding Equipment.

TELEPHONES
Stromberg-Carlson Telephone Co.
Western Electric Co., Inc.

TESTING LABORATORIES
See Ore-Testing Laboratories.

THICKENERS (Slime)
See Slime-Treating Equipment.

TIN AND TERNE PLATES
American Sheet & Tin Plate Co.

TOOL STEEL
See Steel.

TRAMWAYS
See Cableways, etc.

TRANSFORMERS
See Electrical Equipment.

TRANSITS
See Surveying and Drafting Equipment.

TRAPS (Steam)
See Steam Boilers, etc.

TROLLEYS (Overhead)
Ambursen Co. (Tramway Dept.).
Wellman-Seaver-Morgan Co.
Westinghouse Electric & Mfg Co.

TROMMELS
Allis-Chalmers Mfg. Co.
Traylor Engrng. & Mfg. Co.

TRUCKS (Car)
See Cars and Accessories.

TUBE MILLS AND PARTS
See Crushing and Grinding Equipment.

TUBING
National Tube Co.

TURBINES

Steam
Allis-Chalmers Mfg. Co.
De Laval Steam Turbine Co.
Morse Bros. Mchy. & Sup. Co.
Pelton Water Wheel Co.
Southwark Fdy. & Mch. Co.

Water
Albany Lubricating Co.
Allis-Chalmers Mfg. Co.

TURBINE PUMPS
See Pumps.

TUYERES
See Furnaces and Accessories.

TWIST DRILLS
Skinner & Co., M. B.

VACUUM PUMPS
See Pumps.

UNIONS
Lunkenheimer Co.
National Tube Co.

VALVES

Back-Pressure and Check Valves
Jenkins Bros.
Lunkenheimer Co.
National Tube Co.
Wm. Powell Co.

Gate Valves (Iron and Brass)
American Spiral Pipe Works.
Jenkins Bros.
Lunkenheimer Co.
Moore & Co. Engrs., Chas. C.
National Tube Co.
Wm. Powell Co.
Wellman-Seaver-Morgan Co.

Hydraulic Valves
American Spiral Pipe Works.
Lunkenheimer Co.
Moore & Co. Engrs., Chas. C.
National Tube Co.
Pelton Water Wheel Co.
Wellman-Seaver-Morgan Co.
Wm. Powell Co.

Pump Valves
Jenkins Bros.

Safety Valves
Jenkins Bros.
Lunkenheimer Co.
National Tube Co.
Wm. Powell Co.

Three-Throw Valves
Wm. Powell Co.

Valve Re-seating Tools
Skinner & Co., M. B.

VENTILATING FANS
See Fans.

VOLTMETERS
See Electrical Equipment.

WASHERIES (Ore and Coal)
Bartlett & Snow Co.

WATER JACKETS
Allis-Chalmers Mfg. Co.
Chalmers & Williams.
Traylor Engrng. & Mfg. Co.

WATER METERS
See Hydraulic Equipment.

WATER POWER EQUIPMENT
See Hydraulic Mining Equipment.

WATER SOFTENING AND PURIFYING APPARATUS
Scaife & Sons Co.

WELDING & CUTTING APPARATUS
Imperial Brass Mfg. Co.
K-G. Welding & Cutting Co..
Skinner & Co., M. B.

WHEELBARROWS
Atlas Car & Mfg. Co.

WHISTLES
Lunkenheimer Co.
Wm. Powell Co.

WIRE

Flat, Round and Special
American Steel & Wire Co.
Roebling's Sons Co., John A.

Barbed Wire
American Steel & Wire Co.
Roebling's Sons Co., John A.

Wire Rope Fittings
Roebling's Sons Co., John A.

Wire Rope Slings
Roebling's Sons Co., John A.

WIRE ROPE AND CABLES
Ambursen Co. (Tramway Dept.).
American Steel & Wire Co.
Broderick & Bascom Rope Co.
Riblet Tramway Co.
Roeblings Sons Co., John A.

WRENCHES AND VISES
Armstrong Mfg. Co.
Roebling's Sons Co., John A.
Skinner & Co., M. B.

WOOD PRESERVING MACHINERY
Allis-Chalmers Mfg. Co.
Traylor Engrng. & Mfg. Co.

ZINC BOXES
See Cyanide Equipment.

ZINC DUST AND SHAVINGS
See Cyanide Equipment.

ZINC LATHES
See Cyanide Equipment.

ZINC SHAVINGS
See Cyanide Equipment.

The BUREAU of M·I·N·I·N·G INFORMATION

¶ In the compilation of prospectuses, booklets, catalogs, etc., one is frequently at a loss for dependable information, including statistics, with which to properly illustrate the publication, and in consequence much time is lost in the search for same; many times, too, the information is found to be unreliable.

¶ **The Bureau of Mining Information** can save you this loss of time and can give you the required dependable information.

¶ **The Bureau of Information** will also, if desired, undertake the compilation of the publication, illustrate it, print it, and ship it to you complete, all at a reasonable price.

A Quarter of a Century's Experience at Your Service.

Address all communications to

THE BUREAU OF MINING INFORMATION
(NOT INC.)
1422 Monadnock Block
CHICAGO

Reference by Permission, The Mining World Company

DIRECTORY OF ENGINEERS, GEOLOGISTS, ASSAYERS, METALLURGISTS, ETC.

CHEMISTS AND ASSAYERS.

Alexander, M. G., Colo.
Alzugaray, J. Baxeres de, N. Y.
Bacon, W. S., Ore.
Banks, John H., N. Y.
Bardwell, Alonzo F., Utah.
Critchett & Ferguson, Texas.
General Engineering Co., Utah.
Duluth Testing Laboratory, Minn.
Ely, E., N. J.
Falkenburg & Laucks, Wash.
Fueller, C. M., Calif.
Graves, C. A., Minn.
Hanks, Abbott A., Calif.
Havlin, Thomas N., Okla.
Hoskins, Arthur J., Colo.
Houck, Arthur W., Ariz.
Lawrence, T. J., Mex.
Ledoux & Co., N. Y.
Loutzenhiser, W. F., Wash.
Mohave Assay & Engineering Office, Ariz.
Ogden, John, Penn.
Ricketts, Pierre de P., N. Y.
Roos, A. T., So. Dak.
St. Louis Sampling & Testing Works, Mo.
Seamon, W. H. Mex.
Shapley, Edwin, Mex.
Stowell & Co., Wm. H., Wash.
Surr, Gordon, Calif.
Wood & Co., Henry E., Colo.
Worcester, Leonard, Jr., Mex.

CIVIL ENGINEERS.

Anderson & Son, G. Scott, Ida.
Collins, Glenville A., Wash.
Lawrence, T. J., Mex.
Parrott, T. S., S. Afr.
Roland, Walpole, Ont.
Van Dreveldt, E., Mex.

ELECTRICAL ENGINEERS.

Clausen, Carl, Ariz.
Hall, Leon M., Calif.
Riddell, C. W., Ore.
Still, Alfred, Ind.

GEOLOGISTS.

Brower, Walter C., Wash.
DeWilde, F. J., Ills.
Evans, Horace F., Ore.
Hall, Edwin, Wyo.
Hoskin, Arthur J., Colo.
Jones, Fayette A., N. M.
Lakes, Arthur, Colo.
Mercer, W. G., Calif.
Merrill, F. J. H., Calif.
Nicholas, Francis C., N. Y.
Ordonez, Ezequiel, Mex.
Probert, Frank H., Calif.
St. Louis Sampling & Testing Works, Mo.
Storms, Wm. H., Calif.
Weed, Walter Harvey, N. Y.

HYDRAULIC ENGINEERS.

Althouse, H. H. & W., N. Y.
Bassett, R. Smith, Ore.
Jamme, George, Wash.
Riddell, C. W., Ore.

MECHANICAL ENGINEERS.

Clark, V. V., Calif.
Clausen, Carl, Ariz.
Fueller, C. M., Calif.
General Engineering Co., Utah.
Goodall Bros., Mont.
Griffith & Co., T. R., Colo.
Hall, Leon M., Calif.
Jamme, George, Wash.
Kelly, James A., Wash.
Lawrence, T. J., Mex.
Merrill, C. W., Calif.
Newcomb, Clive S., Mex.
Overstrom, G. A., Calif.
Roland, Walpole, Ont.
Shapley, Edwin, Mex.
Welch, R. Kemp, Penn.
Wright, Edward T., Ills.

METALLURGISTS.

Alzugaray, J. Baxeres de, N. Y.
Anthony, W. B., Mex.
Bacon, W. S., Ore.
Banks, John H., N. Y.
Burt, Edwin, Texas.
Canby, R. C., Texas.
Carpenter's Sons, F. R., Colo.
Craddock, Ross S., Wash.
Drury, L. M., Alaska.
Falkenburg & Laucks, Wash.
Fueller, C. M., Calif.
General Engineering Co., Utah.
Hollis, W. L., Ills.
Holms, W. L., Mex.
Hoskin, Arthur J., Colo.
Klepetko, Frank, N. Y.
Long, Frederic H., Ills.
McLachlen, John M., Washington, D. C.
Merrill, C. W., Calif.
Newcomb, Clive S., Mex.
Ogden, John.
Overstrom, Gustave A., Calif.
Probert, Frank H., Calif.
Ricketts, Pierre de P., N. Y.
St. Louis Sampling & Testing Works, Mo.
Shapley, Edwin, Mex.
Spaulding, C. F., Utah.
Thompson, Wm., Ariz.
Traphagen, F. W., Colo.
Tupper, C. A., Ills.
Weed, Walter Harvey, N. Y.
Welch, R. Kemp, Calif.
Wright, Edward T., Ills.

MINING ENGINEERS.

Anderson & Son, G. Scott, Ida.
Anthony, W. B., Mex.
Armstrong, L. K., Wash.
Aubury, Lewis E., Calif.
Bacon, W. S., Ore.
Banks, John H., N. Y.
Barker, Wm., Jr., Wash.
Bassett, R. Smith, Ore.
Beatty, A. Chester, N. Y.-London.
Benedict, Wm. DeL., N. Y
Bolivian D. & E. Co., So. Am.
Borrowe, G. W., Mex.
Bradford, A. H., Wash.
Brower, Walter C., Wash.
Brown, H. B., B. C.
Burrell, W., Aust.
Burt, Edwin, Texas.
Carpenter, F. R., Sons, Colo.
Channing, J. Parke, N. Y.
Clark Bros., Arizona.
Clark, Maurice, Mex.
Clausen, Carl, Ariz.
Collins, Glenville A., Wash.
Craddock, Ross S., Wash.
Creden, William L., Mont.
DeWilde, F. J., Ills.
Drury, L. M., Alaska.
Dunster, Carl B., N. Y.
Evans, H. V., Ore.
Eveland, A. J., Mass.
Falkenburg & Laucks, Wash.
Ferguson, Donald, Nev.
Fesing, Herman W., Mich.
Fields, John D., Mont.
Fishback, Martin, Texas.
Fisk, Winthrop W., Nev.
Fowler, S. S., B. C.
Fueller, C. M., Calif.
Garza-Adalpe, J. M., Mex.
Hall, Edwin, Wyo.
Hall, Leon M., Calif.
Hammond, John Hays, N. Y.
Harrison, A. W., Colo.
Hollis, H. L., Ills.
Hopkins, C. V., Arizona.
Hoskin, Arthur J., Colo.
Humphreys, Llewellyn, Utah.
Jackson, Frank H., Calif.
James, A. Clayton, Nev.
Jamme, George, Wash.
Jones, Fayette A., N. M.
Kelly, James A., Wash.
Klepetko, Frank, N. Y.
Larson, Andrew G., B. C.
Lawrence, T. J., Mex.
Ledoux & Co., N. Y.
Long, Frederic H., Ills.
MacDonald, E. H., Wash.
McPherson, D. E., Mont.
Merrill, Frederick J. H., Calif.
Merrill Metallurgical Co., Calif.
Mohave Assay & Engineering Office, Ariz.
Munro, C. H., San Francisco.
Nicholas, Francis C., New York.
Olsen, Chas. O., Wash.
Ordonez, Ezequiel, Mex.
Overstrom, Gustave A., Utah
Parrott, T. S., S. Afr.
Pirrie, Noble W., B. C.
Poillon & Poillier, N. Y.
Probert, Frank H., Calif.
Reynoso, Jose J., Mex.
Ricketts & Banks, N. Y.
Riddell, C. W., Ore.
Ricketts, Pierre de P., N. Y.
Riordan, D. M., N. Y.
Ritter, Etienne A., Colo.
Roberts, Milnor, Wash.
Roland, Walpole, Ont.
Ropes, L. S., Mont.
Ruhl & Shanklin, Mo.
St. Louis Sampling & Testing Works, Mo.
Scotland, Peter B., Ariz.
Shapley, Edwin, Mex.
Slater, Amos, Wash.
Spaulding, C. F., Utah.
Still, Alfred, Ind.
Storms, L. W., Alaska.
Storms, Wm. H., Calif.
Thomas, Kirby, N. Y.
Thompson, Wm., Ariz.
Traphagen, F. W., Colo.
Trask, George R., Idaho.
Treadwell, Wilbur, Ariz.
Tupper, C. A., Ills
Van Dreveldt, E., Mex.
Vaughan-Rhys, T. J., B. C.
Von Rosenberg, Leo, N. Y.
Watters, D. M., Wash.
Weed, Walter Harvey, N. Y
Welch, R. Kemp, Pa.
Wethered, Roy, Wash.
Wishon, W. W., Calif.
Woodbridge, Dwight E., Minn.

ATTORNEYS.

Du Bois, George, Mex.
McLachlen, John M., Washington, D. C.
Norris, James L., Washington, D. C.
Riddell, H. H., Ore.

SCHOOLS AND COLLEGES.

Chicago School of Assaying, Ills.
Michigan College of Mines.
Van Der Naillen School of Engineering, Calif.

CLASSIFIED BY STATES AND COUNTRIES.

UNITED STATES.

ALASKA.

Drury, L. M.
Storms, L. W.

ARIZONA.

Clark Bros.
Clausen, Carl.
Hopkins, C. V.
Houck, Arthur W.
Mohave Assay & Engineering Office.
Scotland, Peter B.
Thompson, William.
Treadwell, Wilbur.

CALIFORNIA.

Aubury, Lewis E.
Fueller, C. M.
Hall, Leon M.
Hanks, Abbott A.
Jackson, Frank H.
Mercier, W. G.
Merrill, Frederick J. H.
Merrill Metallurgical Co.
Munro, C. H.
Overstrom, G. A.
Probert, Frank H.
Storms, Wm. H.
Welch, R. Kemp.
Wishon, W. W.

COLORADO.

Alexander, M. G.
Carpenter, Franklin R., Sons.
Harrison, A. W.
Hoskin, Arthur J.
Lakes, Arthur
Ritter, Etienne A.
Traphagen, F. W.
Wood & Co., Henry E.

IDAHO.

Anderson & Son, G. Scott.
Trask, George R.

ILLINOIS.

DeWilde, F. J.
Hollis, H. L.
Long, Frederic H.
Tupper, C. A.
Wright, Edward T.

INDIANA.

Still, Alfred.

MICHIGAN.

Dunster, Carl B.
Fesing, Herman W.

MINNESOTA.

Duluth Testing Laboratory.
Woodbridge, Dwight E.

MISSOURI.

Ruhl & Shanklin.
St. Louis Sampling & Testing Works.

MONTANA.

Creden, William L.
Fields, John D.
Ropes, L. S.

NEVADA.

Ferguson, Donald.
Fisk, Winthrop W.
James, A. Clayton.

NEW MEXICO.

Jones, Fayette A.

NEW YORK.

Alzugaray, J. Baxeres de
Banks, John H.
Beatty, A. Chester.
Benedict, Wm. de L.
Canadian Mining Expl. Co., Ltd.
Channing, J. Parke.
Dunster, Carl B.
Hammond, John Hays.
Klepetko, Frank.
Ledoux & Co.
Nicholas, Francis C.
Poillon & Poirier.
Ricketts, Pierre de P.
Riordan, D. M.
Thomas, Kirby.
Von Rosenberg, Leo.
Weed, Walter Harvey.

OKLAHOMA.

Havlin, Thomas N.

OREGON.

Bacon, W. S.
Bassett, R. Smith.
Evans, Horace F.
Riddell, C. W.

PENNSYLVANIA.

Ogden, John.

SOUTH DAKOTA.

McPherson, D. E.
Roos, A. T.

TEXAS.

Burt, Edwin.
Canby, R. C.
Critchett & Ferguson.
Fishback, Martin.

UTAH.

Bardwell, Alonzo F.
General Engineering Co.
Humphreys, Llewellyn E.
Spaulding, C. F.

WASHINGTON.

Armstrong, L. K.
Barker, Wm., Jr.
Bradford, A. H.
Brower, Walter C.
Collins, Glenville A.
Craddock, Ross S.
Falkenburg & Laucks.
Jamme, George.
Kelly, James A.
Loutzenhiser, W. F.
MacDonald, E. H.
Olsen, Chas. O.
Roberts, Milnor.
Slater, Amos.
Stowell & Co., Wm. H.
Watters, D. M.
Wethered, Roy.

WYOMING.

Hall, Edwin.

FOREIGN COUNTRIES.

AUSTRALIA.

Burrell, W.

CANADA.

British Columbia.

Brown, H. B.
Fowler, S. S.
Lakes, Arthur.
Larson, Andrew G.
Vaughan-Rhys, T. J.

Ontario.

Roland, Walpole.

ENGLAND.

Beatty, A. Chester.
Mines Management Co.

MEXICO.

Anthony, W. B.
Borrowe, G. W.
Clark, Maurice.
Eveland, A. J.
Garza-Aldape, J. M.
Holms, W. L.
Lawrence, T. J.
Newcomb, Clive S.
Ordonez, Ezequiel.
Reynoso, Jose J.
Seamon, W. H.
Shapley, Edwin.
Van Dreveldt, E.
Worcester, Leonard, Jr.

SOUTH AFRICA.

Parrott, T. S.

SOUTH AMERICA.

Bolivian D. & E. Co.

Directory of Engineers, Geologists, Assayers, Metallurgists, Etc.

ALEXANDER, M. G. Established 1894
Assayer and Chemist Leadville, Colo.
Gold, Silver and Lead $1. Any two of these 75c; Any one of these, 50c; Copper or Zinc, each $1 Platinum, Nickel or Tin, $5. Write for price list

ALZUGARAY, J. BAXERES de
Analytical, Chemical and Metallurgical research work. Utilization of waste products and raw materials.
55 Liberty St., Room 2301 New York

ANDERSON & SON, G. SCOTT
Consulting Mining Engineers and U. S. Mineral Surveyors
Wallace Idaho

ANTHONY, WM. B.
Mining and Metallurgical Engineer
Guanajuato Mexico

ARMSTRONG, L. K.
Mining Engineer
Codes: Leiber, Bedford-McNeill
Peyton Blk., P. O. Box 2154 Spokane, Wash.

AUBURY, LEWIS E.
Consulting and Mining Engineer
(Late State Mineralogist of California)
Burlingame, California

BACON, W. S.
Assayer, Mining and Metallurgical Engineer
Assaying in all its branches. Examinations and reports on mining properties. Kerby, Oregon.

BANKS, JOHN H., Formerly of Ricketts & Banks
Mining Engineer and Metallurgist.
Special attention to problems in Ore Treatment.
Complete Laboratories. Assays and Analyses.
61 Broadway. New York

BARDWELL, ALONZO F.
Successor to Bettles, Mathes & Co.
Custom Assayer and Chemist
158 So. West Temple St Salt Lake City, Utah

BARKER, WILLIAM, Jr.
Consulting Engineer
Mine Examinations. Ore Problems.
422 New York Building Seattle, Wash

BASSETT, R. SMITH
Placer Mining Engineer
Examinations and Reports. Dredge Equipment Designed and Installed.
Bandon Oregon

BEATTY, A. CHESTER
Consulting Mining Engineer
25 Broad St., New York, N. Y.
1, London Wall Bldgs., London, E. C.
Cable: Granitic.
No professional work entertained.

BENEDICT, WM. DE L.
Mining Engineer
19 Cedar Street New York

BOLIVIAN DEVELOPMENT & EXPLOITATION CO.
Mine Examinations and General Engineering
We make a specialty of examining and reporting on properties in Bolivia, Peru and Chile.
Telegraphic Address: "Boldexo". La Paz, Bolivia

BORROWE, G. W.
Consulting Mining Engineer
New Porter's Hote
Mexico City Mexico

BRADFORD, ALEXANDER H.
Mining Engineer
Alaska Examinations a Specialty
115 Bellevue Ave. N. Seattle, Wash.

BRETHERTON, S. E.,
Consulting Mining and Metallurgical Engineer
Specialty: Smelting of copper and lead ores, and treatment of complex zinc ores
220 Mills Building. San Francisco, Calif.

BROWER, WALTER C.
Expert Mine Examiner
Consulting Engineer
Rooms 509-510 Eagle Blk Spokane, Wash.
P. O. Box 2048

BROWN, H. B.
Mining Engineer
British Columbia mines bought, sold and operated. Correspondence solicited.
725 Pacific Block Vancouver, B. C.

BURRELL, W.
Mining Engineer
Mines Reported on. Management Undertaken
Purchases Negotiated. Correspondence invited
Codes: Bedford-McNeill's;
Broomhall's Comprehensive.
Perth, Western Australia

BURT, EDWIN
Metallurgical Engineer—Specialty: Cyaniding
1121 Arizona St., El Paso, Texas

CANBY, R. C.
Consulting Metallurgist
Low Grade Copper and Lead Ores with Excessive Zinc.
El Paso, Texas

YOUR CARD IN THIS DIRECTORY
Properly displayed, places you in touch with the man who needs your service.

Don't invest blindly--Consult the men in above Directory.

CHANNING, J. PARKE
Consulting Engineer
61 Broadway, New York

CLARK BROTHERS
Placer Mining Specialists
P. O. Box 484 Tuscon, Arizona

CLARKE, MAURICE
Mining Engineer
Mining Investments
Oaxaca, Mexico

CLAUSEN, CARL
Consulting Mining Engineer
Specialty: Plans, Specifications, Estimates. Erection of Mining Machinery, Concentrators, Gold and Silver Mills, Silver-Lead Smelters, Copper Smelting and Converting Plants, Light and Power Plants.
W. U. Code Bisbee, Ariz.

COLLINS, GLENVILLE A.
Consulting Engineer
1201 L. O. Smith Bldg. Seattle, Wash.

CRADDOCK, ROSS S.
Consulting Mining Engineer and Metallurgist
208-209 Columbia Bldg. Spokane, Wash.

CREDEN, WILLIAM L.
Consulting Mining Engineer
Mine Examinations and Management
First Nat'l Bank Bldg. Butte, Montana

CRITCHETT & FERGUSON
(Successors to Hughes & Critchett)
Assayers and Chemists
Umpire and Control a Specialty. El Paso, Tex.

DE WILDE, F. J.
Mining Engineer and Geologist
P. O. Box 333 Galena, Ills.

DRURY, L. M.
Mining and Metallurgical Engineer
Specialty Fairbanks District
Fairbanks, Alaska

DULUTH TESTING LABORATORY
C. A. Graves, Director
Assays Chemical Analyses Cement Testing
Duluth, Minn.

DUNSTER, CARL B.
Mining Engineer
11 Pine St., New York, N. Y.
Marquette, Mich.
Cable: Breitanu McNeill's Codes.

EVANS, HORACE FRANCIS
Economic Geologist
Geologic Examination and Reports
Grants Pass, Oregon Portland, Oregon

FALKENBURG & LAUCKS
Chemists, Assayers, Metallurgists
"Ore Testing on Car Load Lots of Ore"
97 Yesler Way Seattle, Wash.

FERGUSON, DONALD
Consulting Mining Engineer
Codes: Moering & Neal; Bedford-McNeill's
P. O. Box 664 Goldfield, Nevada

FESING, HERMAN W.
Mining Engineer
Lake Superior Copper and Iron Examinations
Houghton, Mich.

FIELDS, JOHN D.
Mining Engineer
Designing and Constructing Copper
Leaching Plants
Maxville, Montana

FISHBACK, MARTIN
Mining Engineer
Cable Address: Fishback. Code: Western Union
Guaranty Trust Bldg., El Paso, Texas

FISK, WINTHROP W.
Mining Engineer
29 years experience (9 years in Mexico)
Jarbidge, Nevada

FOWLER, S. S.
Mining Engineer
Nelson, B. C.

FUELLER, C. M.
Mining Engineer
Concentration, Cyanide and Chlorination Tests
Mills designed and erected
Box 175, R. F. D. No. 2 Whittier, Calif.

GARZA-ALDAPE, J. M.
Mining Engineer
Colorado School of Mines, Stevens Institute of Technology, Member A. I. M. E., A. I. E. E., A. S. M. E. and Mexican Geological Society
Mine Examinations and Reports a Specialty
Calle de Rodriquez No. 5 Torreon, Mexico

GENERAL ENGINEERING CO.
J. M. Callow, President
Consulting Engineers
Salt Lake City, Utah
Ore Testing Mill Designing

HALL, EDWIN
Mining Engineer
Oil and Copper a Specialty
Former State Geologist of Wyoming
Lusk, Wyoming

THIS SPACE COSTS
$21 for one year including a copy of the Mining and Engineering World, each week.

HALL, LEON M.
Consulting Engineer in Mechanics
Electricity, Mining
Telephone Main 989
Room 814 Kohl Bldg. San Francisco, Cal.

HAMMOND, JOHN HAYS
Consulting Engineer
Code: Bedford-McNeill
120 Broadway, New York

HANKS, ABBOT A.
Chemist and Assayer
Control and Umpire Assays. Supervision of Sampling at Smelters. Careful Chemical Analyses
610 Sacramento St. San Francisco, Cal.

HARRISON, A. W.
Mining Engineer
Silverton, Colorado

HATMAKER, BENJAMIN JOY
Consulting Engineer
Specialist in Northern New York Zinc
Examinations. Reports. Assays. Analyses.
Gouverneur, New York

HAVLIN, THOMAS N.,
Assayer and Metallurgist
P. O. Box 346
Commerce, Oklahoma

HITCHCOCK, C. H.
Mining Engineer
Mines examined with a view to purchase
Copper Cliff, Ontario

HOLMS, W. L.
Mechanical Engineer
Specialty: The Cyaniding of Silver Ores
Cable Address: "Holms"
Code: Bedford-McNeill.
Calle de Tiburcio No. 18
P. O. Box 1172 Mexico, D. F.

HOSKIN, ARTHUR J.
Mining Engineer
Examinations, Equipment, Operation Management
Box 526. Leadville, Colo.

Don't invest blindly—Consult the men in above Directory.

HOPKINS, C. V.
Mining Engineer
Chief Engineer and Field Dept.
United Verde Copper Co.
Jerome.

HOUCK, ARTHUR W.
Agent for Ore Shippers
Assayer and Chemist
Bullion Purchased Umpire Work a Specialty
Douglas, Ariz.

HUMPHREYS, LLEWELLYN E.
Mining and Metallurgical Engineer
1022 Black Building, Los Angeles
712 Newhouse Building, Salt Lake City

JACKSON, FRANK H.
Mining Engineer
Room 730, San Fernando Bldg.
Los Angeles, California

JAMES, A. CLAYTON
Mining Engineer
Examination and Reports for Investors
Wonder, Nevada

JAMME, GEORGE
Mining Engineer
Examinations and Reports. Designs for Hydraulic, Metal and Coal Mine Equipment
305 Epler Block, Seattle, Wash.

JONES, FAYETTE A.
Consulting Mining Engineer and Geologist
Specially conversant with the Southwest and Mexico
Albuquerque, New Mexico

JORDAN, EDWIN, C.
Analytical Chemist and Mining Engineer
Rare Metals a Specialty
10 Park Street, Gouverneur, N. Y.

KELLY, JAMES A.
Mining Engineer
Coal Mine Examinations and Equipment
740 Henry Building Seattle, Wash.

KLEPETKO, FRANK
Consulting Engineer, Mining and Metallurgy
Specialty: Metallurgy of Copper
Lately Manager Boston and Montana Con. Copper and Silver Mining Co., and of the Reduction Works of the Anaconda Copper Mining Co., of Montana. At present Consulting Engineer Cerro de Pasco Mining Co. of Peru; Boston and Montana Consolidated Copper and Silver Mining Co. of Montana and Michigan Copper Smelting Co. of Michigan.
Rooms 1706-08
42 Broadway, New York

LAKES, ARTHUR
Mining Properties Examined and Reported On
701-2 Gas & Electric Bldg. Denver, Colo.
Temporary Address: Ymir, B. C.

LARSON, ANDREW G.
Mining Engineer
907 Vancouver Block, Vancouver, B. C.
Code: Bedford-McNeill

LAWRENCE, T. J.
Mining Engineer
Examinations, Reports, Assays and Analyses
Plants Designed and Constructed
Topia, Durango, Mexico

LEDOUX & CO., Inc.
Mining Engineers and Assayers
Ore and Metal Sampling at the Port of New York. All important foreign and eastern refiners and most important American producers settle upon Ledoux & Co.'s certificate of weight and assay.
99 John Street New York

LONG, FREDERIC H.
Consulting, Mining and Metallurgical Engineer
637, 29 South La Salle St. Chicago

LOUTZENHISER, W. F.
Assayer and Chemist
Telephone No. 91 Republic, Washington

MAC DONALD, E. H.
Mining Engineer
Realty Building Spokane, Washington

McPHERSON, D. E.
Mining Engineer
27 Forest Ave. Deadwood, South Dakota

MERCIER, W. G.
Economic Geologist
Valuations and Reports a Specialty
20 years experience in Pacific Coast mining
Correspondence Solicited
Yreka, California

MERRILL, CHARLES W.
Metallurgist
Precious Metal Ores Tested and Processes Devised. Mills designed, installed and operated. Licenses issued for Merrill Classification Treatment and Precipitation Patents.
121 Second St. San Francisco

MERRILL, FREDERICK J. H.
Consulting Geologist and Mining Engineer
Late State Geologist of New York
631 Higgins Bldg. Los Angeles, Cal.

MERRILL METALLURGICAL CO.
Engineers
121 Second St., San Francisco
Cable: Lurco Usua Codes

MOHAVE ASSAY & ENG. OFFICE
R. M. Strassel R. C. Jacobson
Mining Engineers and Assayers
Reports on Mines Kingman, Ariz.

MUNRO, C. H.
Mining Engineer
Hobart Bldg., San Francisco
Cable: Ornum Code: McNeill.

NEWCOMB, CLIVE S.
Mechanical and Metallurgical Engineer
Code: Bedford-McNeill
Black Lake, Quebec, Canada

NICHOLAS, FRANCIS C.
Mining and Economic Geologist
Investigations, Analyses and Reports in regard to Ores and Minerals
Permanent Address:
National Art Club, New York
Temporary Address: Nogales, Arizona

OGDEN, JOHN
Metallurgist—Chemist
Electro-Metallurgy of Gold, Silver and Platinum. Ore testing plant.
906 Filbert Street. Philadelphia, Pa.

OLSEN, CHAS. O.
Mining Engineer
Mine Examinations and Reports
Surveying
So. 7½ Stevens St Spokane, Wash.

ORDONEZ, EZEQUIEL
Consulting Mining Geologist and Engineer
Mine Examination Valuation of Mines
Prospecting Works
Avenida General Prim 1245
Mexico City, Mexico

OVERSTROM, GUSTAVE A.
Consulting Engineer
Mill and Smelter Construction
Specialty: Concentration of Ores
507 Germane Bldg. Los Angeles, Cal.

PARROTT, T. S.
Mining and Consulting Engineer
173 Exploration Bldgs., Johannesburg, S. Africa
Codes: Bedford-McNeill and A. B. C., 5th Edition. Cable: "Parophite"

POILLON & POIRIER Howard Poillon C. H. Poirier
Mining Engineers
63 Wall Street, New York City

PROBERT, FRANK H.
Consulting Mining and Geological Engineer
Hobart Building San Francisco, Calif.

REYNOSO, JOSE J.
Mining Engineer
Edificio de la Campania Bancario
Avenida Cinco de Mayo No. 32 Apartado 766
Mexico City, Mexico

A PROPER DISPLAY
of your professional card will bring you much better returns than in any other way. It's at a very low cost.

Don't invest blindly—Consult the men in above Directory.

RICKETTS, PIERRE DE P.,
Mining, Metallurgical and Chemical Engineer. Examinations of Mines and Properties. Determination of Method of Ore Treatment. Assays and Analyses. 80 Maiden Lane, New York

RIDDELL, C. W.
Mining and Hydro-Electrical Engineer
Examination and Reports on Mines and Water Power
357 Chamber of Commerce Bldg. Portland, Ore.

RITTER, ETIENNE A.
Mining and Consulting Engineer
Colorado Springs, Colorado

ROBERTS, MILNOR
Mining Engineer
University Station. Seattle, Washington

ROLAND, WALPOLE
Mining and Civil Engineer
Member Dom. Inst. Ama. Engrs. Surveys and Underground Plans a Specialty. Cable "Roland," Moreing's and Neil's Code. Port Arthur, Ont.

ROOS, A. T., Ph. D.
Assayer and Chemist
Sampling and Testing Antimony and Free Milling Ores.
Deadwood, South Dakota

ROPES, L. S.
Mining and Consulting Engineer
Helena, Montana

RUHL & STEWART
Mining Engineers
Rooms 609-10-11 Keystone Bldg.
Joplin, Mo.

ST. LOUIS SAMPLING AND TESTING WORKS
Robert W. Barrell, Manager
713 Clark Ave., St. Louis, Mo.
Chemists, Metallurgists and Consulting Engineers
Geological and Mine Examinations and Reports
Metallurgical investigations of ores and plans for treatment. Consulting Management of Mines. All kinds of assays, analyses and chemical investigations. Weighing and sampling car load shipments for shipper or purchaser. Umpire control work a specialty.

SCOTLAND, PETER B.
Mining Engineer
General Superintendent of Mines, the Arizona Copper Co., Ltd. Morenci, Arizona

SEAMON, W. H.
Chemist and Assayer
Umpire and Control Assays. Water Analyses; Leaching Tests and Examination for Rare Metals.
Chihuahua, Mexico

SHAPLEY, EDWIN
Cyanide Metallurgist
Examinations, Reports, Assays and Analyses
Plants Designed and Built
Cyanidation and Concentration a Specialty
Cable Address: Shapley
Codes: Bedford-McNeill and Western Union
Guanajuato, Mexico

SLATER, AMOS
Mining Engineer
Specialty—Coal and Coal Briquetting
Henry Building Seattle, Wash.

SPAULDING, C. F.
Consulting Engineer and Metallurgist
122 E. So. Temple St. Salt Lake City, Utah

STILL, ALFRED
Fellow A. I. E. E.; Inst. E. E
Consulting Electrical Engineer
Hydro-Electric Developments and Power Transmission.
Purdue University La Fayette, Ind.

STORMS, L. W.
Mining Engineer
P. O. Box 65 Valdez, Alaska

STORMS, WILLIAM H.
Mining Geologist and Engineer
Mining Methods a Specialty.
2437 Hilgard Ave. Berkeley, California

THOMAS, KIRBY
Mining Engineer
Examination and Valuation of Mining Properties.
Room 2744, 120 Broadway, New York
Cable: "Kirthom". Code: Bedford-McNeill.

THOMPSON, WILLIAM
Mining and Metallurgical Engineer
Mine Examinations. Ore Tests Conducted.
Correspondence Solicited
Douglas, Arizona

TRAPHAGEN, F. W.
Ore Treatment
The Colorado School of Mines
Golden, Colorado

TRASK, GEORGE R.
Consulting and Mining Engineer
U. S. Mineral Surveyor
30 years active experience Wallace, Idaho

TREADWELL, WILBUR
Mining Engineer
Phoenix, Arizona

TECHNICAL BOOKS
You can get any book published by addressing The Mining World Co., Chicago.

TUPPER, C. A.
Consulting Engineer
Mining—Metallurgy—Power
515 Monadnock Block, Chicago

VAN DREVELDT, E.
Civil and Mining Engineer
P. O. Box 91, Parral, Chihuahua, Mexico

VAUGHAN-RHYS, T. J.
Mining Engineer
Examination and Management of Mines
Advice given on Portland Canal Investment.
Stewart, British Columbia

VON ROSENBERG, LEO
Consulting Mining Engineer
Cable Porphyry, N. Y., 42 Broadway, New York

WAHL, H. R.
Mechanical Engineer
Design and Construction of Crushing, Milling and Mining Plants
1218 First National Bank Bldg., Chicago

WATTERS, D. M.
Mining Engineer
Bedford-McNeill and Western Union Codes
1315 1st Avenue W. Seattle, Wash.

WEED, WALTER HARVEY
Mining and Legal Geology and Mine Valuation
29 Broadway, New York

WELCH, R. KEMP.
Mining and Metallurgical Engineer
Mine Examination and Reports
Fort Bidwell, California

WETHERED, ROY
Mining Engineer
Paulsen Bldg., Spokane, Wash.

WISHON, W. W.
Consulting Engineer
Formerly Supt. Speculator Mine, Now North Butte.
Member Amer. Inst. of Mining Engineers.
Examinations—Development—Management of Mines.
Searchlight, Nevada

WOOD & CO., HENRY E.
Assayers
Ore Tested in Car-Load Lots.
Write for Circulars
1734 Arapahoe St. Denver, Colo.

Don't invest blindly—Consult the men in above Directory.

WOODBRIDGE, DWIGHT E.

Consulting Mining Engineer

Duluth, Minnesota

WORCESTER, LEONARD, Jr.
Assayer and Chemist
Chihuahua Ore Testing and Sampling Co.
Calle Aldama 107, Chihuahua, Mexico

WRIGHT, EDWARD. T.

Ore Milling Engineer

1730 First National Bank Bldg.

Chicago, Ills.

ACCOUNTANTS.

DUNLOP, W. M.

Chartered Accountant and Auditor

Citizen Bldg., Ottawa, Ont.

Mining and Hydraulic Power Accounting and Auditing.

ATTORNEYS.

DU BOIS, GEORGE
Counselor Advocate
Member Bar of Supreme Court of California
Practitioner for 10 years in Courts of Mexico
Official Translator of Pan-American Congress 1902
Specialty: Legalization of Foreign Companies in Mexico, Redaccion or export translation of Articles of Incorporation, By-Laws, Etc.
2a Calle de Armenta y Lopez 12
Oaxaca, Oxa., Mexico

McLACHLEN, JOHN M.
Attorney at Law
Patents Trademarks
Union Trust Bldg., Washington, D. C.

NORRIS, JAMES L. Established 1869
Counselor in Patent Causes
Member Patent Law Association.
Solicitor of American and Foreign Patents
Norris Building Washington, D. C.

RIDDELL, H. H.
Attorney and Counselor at Law
All Business in U. S. and Territory of Alaska Carefully Attented to.
735 Chamber of Commerce Blk. Portland, Ore.

CUSTOM BROKERS AND AGENTS

CAMPHUIS & RIVES
Custom Brokers—Agents for Mining Companies
Mills Building, El Paso, Texas
Camphuis-Rives Co., Tampico, Mexico, Apartado 311
Camphuis-Rives Co., Laredo, Texas, P. O. Box 172
Camphuis-Rives Co., Vera Cruz, Mexico, Apartado 235

SCHOOLS AND COLLEGES.

MICHIGAN COLLEGE OF MINES
A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and Booklet of Views address President or Secretary.
Houghton, Michigan

A. VAN DER NAILLEN SCHOOL OF ENGINEERING Established 1864
Mining Engineering
Practical Assaying taught in 12 months. No Special preparation necessary. Individual instruction only, by expercienced engineers. Terms reasonable.
Write for Catalog.
51st and Telegraph Ave. Oakland, Calif.

MINING BROKERS AND BANKERS.

PROBERT, BIDWELL & CO.
Copper Mining Stocks
Capital City Bank Bldg., Santa Fe, New Mexico
Only the best Copper Stocks handled
Correspondence Solicited from Investors and Brokers

W. G. CRAIG

If you want Gold, Silver, Lead or Copper Properties, write me.

414 Atlas Block Salt Lake City, Utah

HOWARD E. DAVIS
Mine Investigator
Specializes in Preliminary Investigations of and Reports on Properties in the south-western part of the United States
Commissions to find and purchase properties undertaken.
604 I. W. Hellman Building, Los Angeles, Calif.

A. HERMAN
Mining Broker
505-6 Rookery Bldg., Spokane, Washington
Handling best line Coeur d'Alene Stocks
Correspondence Solicited from Investors and Brokers

MINES & MINING BUREAU
H. L. Damschroder, Manager
Silverton, Colo.
Reports on Mines, Prospective Mines and Prospects for $1.00 and up. We have a record of over 1,300 claims and mines, what they are, what they are doing and their possibility, located in the Golden San Juan. Correspondence solicited.

THIS SPACE COSTS
$21 for one year including a copy of the Mining and Engineering World, each week

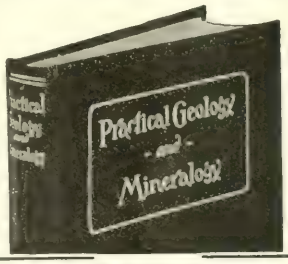
W. D. PEARCE
Genl. Mgr Sonora Engineering & Mining Co.
Apartado 22 Alamos, Sonora, Mexico
Mine Examinations and General Engineering
First Class Mining Properties Handled
Codes: Moreing and Neal and Bedford-McNeill
Cable Address: Semco

L. N. ROSENBAUM
Stocks—Bonds
Corporation Financing
Corporations organized anywhere in United States or Foreign Countries
Stock and Bond issues prepared and negotiated.
80 Wall Street, New York

TECHNICAL BOOKS
You can get any book published by addressing The Mining World Co., Chicago.

MAPS
Compiling, Drawing, Engraving
Relief Models
A. BRIESEMEISTER, 1656 Holland Ave., NEW YORK

The Assay of Tin and Antimony :: *Second Edition* **Price, $2.00**
By L. PARRY, A. R. S. M.
Mining World Company - Chicago



Written For The
Student, Prospector and Mining Man
By W. D. HAMMAN, B. Sc.
256 Pages Nearly 100 Illustrations
This book covers, in a general way, the four important phases of mining—
Geology Mineralogy
Petrology Mineral Deposits
Written by a practical field man for the mining man. As far as possible, technical phrases have been left out.
The How and Why Book
Answers over 200 practical questions, telling "how" and explaining "why."
Price, $2.50
MINING WORLD COMPANY
1419 MONADNOCK BLOCK : CHICAGO

Don't invest blindly—Consult the men in above Directory.

CLASSIFIED WANT ADVERTISEMENTS

Advertisements will be inserted under this heading at the rate of two cents per word for each insertion. Make remittances by stamps, P. O. order or checks.

SITUATIONS WANTED

STENOGRAPHER, OFFICE MAN, AMERican, 27, single, 8 years' mining, commercial experience. Excellent credentials. Habits exemplary. Intelligent, reliable. Now employed. Location immaterial. Address No. 777, Mining & Engineering World, Chicago.

CHIEF SURVEYOR, OVER 10 YEARS' practical experience, technical training, A. M. I. M. E., desires change; at present engaged. Not quite 32. Go anywhere. Salary $115. Address No. 775, Mining and Engineering World, Chicago.

CHEMIST AND ASSAYER, 4 YEARS' experience. Best references. Will go anywhere. Address R. F. H., Mining and Engineering World, Chicago.

MR. CHIEF ENGINEER,

ANY MINING COMPANY.

I AM AN AMERICAN, 28 YEARS OLD, AND MARRIED. I CAN OFFER 5 YEARS' RAILROAD AND 3 YEARS' GENERAL ENGINEERING EXPERIENCE; PERSONALITY, TACT, A STRONG LIKING FOR WORK, AND A HIGH REGARD FOR MY EMPLOYER'S BEST INTERESTS.

IF YOU WILL OFFER A PLACE WHERE ABILITY IS RECOGNIZED BY ADDITIONAL RESPONSIBLTY AND AN INITIAL SALARY OF $125 PER MONTH

ADDRESS C. W. B., MINING AND ENGINEERING WORLD, CHICAGO.

PRACTICAL MILL SUPERINTENDENT wishes change; 17 years' experience. Thoroughly familiar with the minor details of concentration and care of machinery. Experienced in concentration of copper, lead-zinc and lead-zinc-copper ores. For the past 3 years superintendent of a lead-zinc-copper concentrator in the southwest. Speaks Spanish. First-class references. Address No. 780, Mining & Engineering World, Chicago.

A YOUNG MAN, EXPERIENCED PROSpector and packer in mule trains, would like position with reliable company operating in South America. Am strictly on the square. Can furnish good references. Address No. 790, Mining and Engineering World, Chicago.

TECHNICAL GRADUATE, SURVEYING and assaying experience, 2 years' mining and some prospecting experience; can change [illegible] salary $125. Would like to take charge of small property, or secure some other responsible position. Address No. 791, Mining and Engineering World, Chicago.

MINE MANAGER WOULD CHANGE. Many years' experience with world's largest companies. Specialty, low cost production. Spanish experience. Address "B," Box 121, Jerome, Ariz.

MINE ACCOUNTANT, 30 YEARS OLD; 12 years' office experience; 5 years with mines. Understands cost accounting, pay roll works and best mine office systems. Also thorough stenographer. Address 790, Mining & Engineering World, Chicago.

POSITIONS VACANT

ENGINEERS DESIRING BETTER POSItions or those out of employment, should consult The Copper Handbook. It gives the names and addresses of 3016 copper mining companies and their officers. It also gives an account of the company's holdings, developments, equipment and reliability. Special reduced price to Mining World readers, $3. It will be sent postpaid on receipt of price. The Copper Handbook, 29 Broadway, New York.

WANTED — SUPERINTENDENT FOR iron ore washing plant, including log washers and jigs. Must be familiar with mechanical details as well as electric power equipment. Address T. C., Mining World.

SEVERAL RECENT MINING AND metallurgical graduates wanted as chemist, assayer and engineer by western mining companies. $90 to $120. Business-Men's Clearing House, Denver, Colo.

CONCENTRATOR MILLMAN WANTED— A working superintendent or foreman in a small mill in suburb of Chicago. Prefer man with flake graphite milling experience. Give references; salary expected. Address No. 781, Mining & Engineering World, Chicago.

¶ The postage stamp seems to have the right system. It sticks to it 'till it gets there.

WANTED — METALLURGICAL ENGIneer with western experience in selling mill and smelter equipment. Address No. 783, Mining and Engineering World, Chicago.

FOR SALE—MINING PROPERTY

FOR SALE—PYRITE PROSPECT, CENtral Mass., about 27 miles from the old Davis mine that paid well for years. Surface indications are right for a paying mine. Some copper and gold values. Address H. N. Kirk, Orange, Mass.

FOR SALE—CONTROLLING INTEREST in Washington producing free-milling gold mine; 15-ton capacity mill, sawmill, air compressor, tables, plates, drills, water power, all installed. Ten claims with two veins of high-grade quartz, 8 to 10 ft. wide. Handsome profit for party controlling capital. Address No. 766, Mining & Engineering World, Chicago.

FOR SALE BY OWNER — GOLD AND silver mine located in proven district 3 miles south of Mojave, Calif. 8 claims covering outcrop of number of ledges. Main shaft 208 ft. deep to water with about 400 ft. of drifts. Estimate 8000 tons of ore in sight that will average over $10 in free milling soft ore. Will deed an interest for further development below water or will sell outright. An unusual opportunity to acquire a property above the average offered. Mine now warrants the installation of plant. J. E. Whitmore, Mojave, Kern Co., Calif.

FOR SALE—A FINE ZINC PROPERTY in East Tennessee, estimated at 10,000 acres. East Tennessee is developing into one of the finest zinc producing sections in the world. J. M. Woodson, LaFollette, Tenn.

COPPER-GOLD PROPERTY FOR SALE; patented over 3 years; ore blocked for 50-ton mill. Particulars to reliable parties. Address Box 656, Prescott, Ariz.

FOR SALE—5 CONNECTED CLAIMS IN Pinos Altos district, adjoining Savannah Copper Co. claims, and a half mile east of Empire Zinc Co. Cleveland mines. Assays as high as $18 gold, 30 ozs. silver, 25% zinc and 20% lead. Can be had at a bargain. Address Otto Forster, Silver City, New Mexico.

FOR SALE—ONE-THIRD INTEREST IN gold mine; money for an addition of a cyanide plant to our mill. Mines in S. C. Thousands of tons ready; $5,000 required. Address P. O. Box 516, Idaho Springs, Colo.

FOR SALE—AT YOUR OWN PRICE, SILver lead and zinc mine Group of 4 claims side-lining the Standard, British Columbia, Canada. Address No. 767, Mining & Engineering World, Chicago.

FOR SALE—COPPER-GOLD MINE, LOWer California; tide water location; 6000 tons shipping ore on dump; emphatically principals only. "B," Box 124, Jerome, Ariz.

FOR SALE—GOLD MINING PROPERTY in Ontario. Patented. Large acreage. Promising gold-bearing quartz veins. Undeveloped; reasonable price. Payments, small amount down, balance from promotion or production. Address No. 792, Mining and Engineering World, Chicago.

FOR SALE, LEASE OR BOND—COPPER property, 35 full claims, 9 miles from railroad, good road to property, 50 miles from smelter. This is a prospect, but a good one, and will stand up under the strictest investigation. For further information write W. W. Ramsey, P. O. Box 626, San Bernardino, Calif.

WILL LEASE, BOND OR SELL ONE OR various mines of the following minerals: Copper, manganese and lead. These mines have unassailable titles, are near the coast and have ore in sight. Some of the shafts and galleries have been inspected by A. F. Provot, M. E. 60 or 90-day options. For particulars address Prof. L. A. Cisneros, Santa Rita, Oriente, Cuba.

ANY PERSON WISHING INVESTMENT in mineral or timbered lands in North Arkansas, whether Marion or Baxter Counties, write Mrs. L. L. Seawell, Freewater, Ore., who will make prices interesting.

FOR SALE—WORKING BOND ON GROUP of silver-lead and gold veins; ideal proposition for tunneling and transportation, in proven district, near the greatest zinc mines in Coeur d'Alene. Seeing is believing. Address Box 13, Sunset, Idaho.

FOR SALE—200 ACRES COPPER PROPerty in Ajo district, Arizona, near New Cornelia; 10 or more large veins traverse property. Rich ore has been taken out. Very easy terms. Might accept one-half in stock. Address Irving Payne, Area, Ill.

AMERICAN CHAMBER OF MINES—AN organization to serve the interests of mining as a business and to develop facilities for securing financial co-operation. We have enough societies to develop ethics in mining, and they are good, but property owners need business, and the only way to get it is to go after it. Parties interested may address: Francis C. Nicholas, care National Arts Club, New York; Hotel Orndorff, Tucson, Ariz., P. O. B. 294, Nogales, Ariz., or Thomas G. Lewis, Washington, D. C.

QUICKSILVER PROPERTY FOR SALE—Large tonnage proposition; located in central Nevada. Wood and water in abundance on ground. Address Frank Maloney, Box 1213, Goldfield, Nev.

FOR SALE — HIGH-GRADE FLAKE graphite property, located in the Province of Quebec, with mining rights on 400 acres; complete with mill and boarding house. Present capacity of mill 1½ tons refined to 92%, in 10 hours. Good shipping facilities. Easy terms to responsible parties. Address No. 614, care Mining and Engineering World, Monadnock Blk., Chicago.

ANTIMONY LANDS FOR SALE AND lease; rich veins assaying 55 to 70% pure antimony. H. Towson, Dequeen, Ark.

FOR SALE 200 ACRES OF ZINC MINeral land, 3 miles west of Joplin, Mo., located on both sides of the Seventh St. road. W. S. Dewing, Kalamazoo, Mich.

COPPER PROPERTY, 35 MILES FROM railroad, for sale, lease or bond. Easy terms. Advance payment unnecessary. Ed Christiernsson, Jungo, Nev.

ZINC MINE FOR SALE — DEVELOPED. A good one. Highest grade ore in America. Address Chas. P. Basye, 5604 Kingsbury Court, St. Louis, Mo.

FOR SALE—BARGAINS—PART OR ALL in large, valuable hematite deposits, 100,000 tons blocked out, average $9.24. Gold, silver, lead, zinc in same and adjoining properties. Close to dividend payers, water power near. Also interest in valuable inventions. Chance for quick, large profits. Address Ernest Thompson, Northport, Wash.

GOLD MINES OF NEVADA COUNTY and adjacent districts, largest producers of America, for sale; all kinds, royalty basis; also expert reports given and made on mining property and companies. Mines Bureau, Box 214, Nevada City, Calif.

FOR LEASE—NEVADA SILVER PROPerty, with nearby lead and zinc claims, quicksilver and amalgam dump and tailings. Expert details on request. Frank Stollenwerck, Montgomery, Ala.

COPPER PROPERTY FOR SALE—$5000 cash and $5000 in 60 days. $500,000 worth of ore in sight. Average 13% copper carrying good gold values; 12 miles to railroad on good wagon road; 100 miles to Tacoma Smelter. Property easily worth $75,000. Sacrifice for quick sale. D. J. Hancock, 715 Olive St., Seattle, Wash.

FOR SALE — MINING MEN: A GOOD silver-lead property in Montana; 4 full claims patented. This is a good proposition, rich in silver and lead, and will be sold on fair terms. R. G. Poland, Lewistown, Mont.

THREE MINING LOCATIONS IN ALLAmore district. Small capital can handle this. H. E. Bacon, Allamore, Tex.

FOR SALE—MINING PROPERTIES, DEveloped and undeveloped. Address Herman, 505 Rookery Bldg., Spokane, Wash.

FOR SALE OR LEASE AND BOND—Gold, silver, copper or antimony, partly developed mines, or would give interest for development work. Some very good properties on which to incorporate. Location of properties in Copper Basin, Hassayampa, Big Bug and Peck mining districts, all in Yavapai County, Arizona. Only principals need apply. References, Dun's or Bradstreet's. E. Block, Owner, Prescott, Ariz.

FOR SALE—MINING PROPERTY; OWNer to reopen gold mine near Goldfield, Nev.; 2 deep shafts in pay ore; 3-ft. vein; 500 tons on dump; $10 value; tons of high grade ore has been shipped. Will give half interest for $10,000 working capital; no stock considered. Address I. Fechheimer, 520 Post St., San Francisco, Calif.

FOR SALE — MOUNTAIN OF HIGH grade iron ore at 25 cts. per ton. Millions of tons in sight. Close to railroad. Address No. 785, Mining and Engineering World, Chicago.

WANTED — INVESTORS, BUYERS AND promoters of gold, silver, copper, lead, zinc, etc., and rare metals. Partially developed mines and prospects, just across the Colorado river from Oatman, Ariz., in Ibex mining district, San Bernardina county, California. Nick Jahreiss, Box 921, Needles, Calif.

OPPORTUNITY EXTRAORDINARY.

HALF INTEREST IN

IMMENSELY VALUABLE GRAPHITE

PROPERTY FOR SALE.

ENGINEERS REPORT

VEIN 200 FT. WIDE EXTENDING FOR

HALF MILE CONTAINING PRACTI-

CALLY INEXHAUSTIBLE SUPPLY.

EMINENT AND WIDELY TRAVELED

METALLURGICAL CHEMIST CLAIMS

LOCATION THIS PROPERTY IN

COUNTY CONTAINING GREATER VARI-

ETY OF MINERAL WEALTH THAN ANY

SECTION OF THE WORLD WITH

WHICH HE IS FAMILIAR. SALE

PRICE ($60,000) TO BE USED IN DE-

VELOPING WHOLE PROPERTY.

ADDRESS BOX NO. 528, BIRMINGHAM,

ALABAMA.

FOR SALE — COPPER CLAIMS IN Globe, Miami, Ray, Superior, Arizona billion dollar copper district; several exceptionally well located and developed properties at reasonable prices and terms. H. M. Brown, Mining Broker, Box 4, Miami, Ariz.

FOR SALE — COPPER, GOLD, SILVER, lead and zinc mines. Roman Armijo, P. O. Box 517, Clifton, Ariz.

IF A MINING MAN WITH FINANCIAL backing is satisfied with $1 to $5 a ton, unlimited quantity low-grade gold ore in Maricopa county, Arizona, he can deal on business terms by writing for particulars to Room 18, 20th floor, 100 Broadway, New York.

SPLENDID OPPORTUNITY

FOR

VERY PROFITABLE INVESTMENT.

Responsible mining house of many years' successful experience wishes to sell several mines owned and under option. Reason for offering is excess of favorably reported properties over house's requirements.

For further particulars apply to

BREITUNG & CO., Ltd.,

11 Pine St. New York.

WANTED—MINING PROPERTY

[illegible] ANTIMONY MINE, STATE location, character and quantity of ores, [illegible] Address "Manufacturer," [illegible] C, New York.

WANTED—INFORMATION REGARDING mining stock or mine for sale. Send description and price. R. G. List, Minneapolis, Minn.

FOR SALE—NICKEL PROPERTY IN Canada. Huge outcrop pyrrhotite deposits undeveloped. Assays nickel, copper and gold; formations similar to Sudbury district. Address No. 793, Mining and Engineering World, Chicago.

PRACTICAL MINING ENGINEER WOULD like to lease a small mining property or form partnership with someone who has a good claim. Montana or Idaho preferred. Chas. Russell, 521 E. Galena St., Butte, Mont.

WANTED IMMEDIATELY—LARGE COPper mine, valued from $1,000,000 to $5,000,000. Must stand rigid investigation. No inflated prices. Address Thos. G. Aitken, Deming, New Mexico.

WANTS—MISCELLANEOUS

I AM MINING 45% MANGANESE AS well as manganiferous iron ore and want buyers for the products. Write Henry V. Maxwell, Bristol, Va.

WANTED—PARTY FURNISH CAPITAL to operate gold and silver property of merit; ores high-grade; 300-ft. shaft; complete plant machinery, including pumps handle water; liberal and satisfactory division. Address Lock Box C, Bozeman, Mont.

WANTED TO SELL CHEAP TO RELIable Party—Block of stock in Utah silver-gold property. Best proposition in mining in the west. Sale is made to settle estate. Purchaser becomes director in company. Clean, reliable company. Can give bank references. Address, Fred R. Pryor, Minersville, Utah.

WANTED TO BUY—HIGHEST PRICES paid for used carbons (Black Diamonds) and fragments. Maurice S. Dessau, 6 Maiden Lane, New York, N. Y.

WANTED—AT ONCE, PARTY WITH $5,000 to invest in gold, silver and lead proposition close to Helena, for one-third interest. Machinery already installed good for 300 ft.; now in operation. Ore in sight, but further development necessary. Address Box 133, Helena, Mont.

AGENCY WANTED BY RELIABLE party for mining machinery and machine tools in Spain. Address Gumersindo Garcia, Marques de San Esteban 50, Gijon, Spain.

WANTED — ANTIMONY ORES. STATE price, percentages, analysis, quantity can be delivered monthly, and points of delivery. Address "Manufacturer," Station C, New York.

WANTED—RESPONSIBLE CONCERN TO consolidate two gold properties and organize company for their development. Location, Colorado. Both high and low grade ore, free milling. Address No. 776, Mining and Engineering World, Chicago.

ZINC CARBONATE WANTED IN CARload lots. Send sample. Quote price. Delaware Hard Fibre Company, Marshallton, Del.

WRITE HELENA MINING BUREAU, Inc., Helena, Mont., for booklet describing mining investment opportunities in the Helena Mining Region as outlined in Bulletin No. 527, United States Geological Survey.

MINING ENGINEER REQUIRES $1500 for particular opportunity. Anyone broad-minded enough to recognize a real opening for large profit on a small outlay and with security furnished against miscarrying of plans will receive comprehensive details, replies being treated confidentially, from No. 791, Mining and Engineering World, Chicago.

Want Advertisements Continued on Next Page.

WANTED—MANGANESE ORE TESTING 50% metallic manganese or better; also antimony ore testing 45% metallic antimony or better; give assay, tonnage, etc., in first letter. Address No. 787, Mining and Engineering World, Chicago.

WANTED—A PARTNER TO DEVELOP A galena-zinc prospect adjoining a dividend payer. Address Lock Box 205, Wallace, Ida.

WANT TO BUY MINING STOCK. GIVE name of company and lowest cash price. Address P. O. Box 337, Fort Worth, Texas.

WANTED—STOCK SALESMAN. MINE on Tightner serpentine belt, Sierra County. Proven bonanza ore. Capital needed immediately for equipping and sinking. Liberal commission. Finney Mines, Inc., 825 10th St., Sacramento, Calif.

WANT INFORMATION ON GOOD MINing opportunities for investments. Address "C," Box 296, Nevada City, Nevada county, Cal. Only principals considered.

WANTED — 25,000 TONS MANGANESE ore, 80% or better, Mn. O_2 and not over 1% iron; 500 tons Tungsten concentrates 60% WO_3 or better. Could also use 40% at a lower price per unit. Chronite—10,000 tons 50% C_2O_3. G. S. Scott, Room 25, 20 Nassau St., New York.

WANTED — USED CARBONS (BLACK Diamonds) and fragments. Will pay highest prices. S. Dessau's Son, 180 Broadway, New York. N. Y.

FOR SALE—MISCELLANEOUS

STIBNITE ANTIMONY ORE 40 TO 60%. Can deliver in carload lots f. o. b. Berlin, Wash. Less than 1% of impurities. Correct analysis of ore given on request. D. J. Hancock, 401 Joshua Green Bldg., Seattle, Wash.

ASSAY OFFICE FOR SALE CHEAP IN Arizona. Address No. 788, Mining and Engineering World, Chicago.

DO YOU KNOW THAT YOU COULD test your own ores by Way's Process? Send for booklet describing this simple and economical method. Accurate and reliable. Used by mining schools and colleges. No technical knowledge required. Way's Pocket Smelter Sales Co., Dept. H, South Pasadena, Cal.

ANTIMONY EXPERT AND HIS ASSISTant are prepared to negotiate with firms for the erection and operation of plant for the latest French sublimation process. Norman L. G. Whitehouse, "The Meyran," Meyran Ave., Oakland, Pittsburgh, Pa.

WANTED — PARTIES WITH CAPITAL to assist in the working of an undeveloped mining property, near Phoenix, Ariz. Value, $10 per ton or better. Free gold. Address M. J. Powell, 817 West Jefferson St., Phoenix, Ariz.

FOR SALE—SYNDICATE FORMING TO operate gold, silver, lead, zinc mine. Ore averages over $50 per ton. Own furnace; 4 more members needed. Large income on moderate investment. Address No. 774, Mining and Engineering World, Chicago.

ANTIMONY ORE—RESPONSIBLE MANufacturer would like to contract for moderate amounts monthly; give analysis, tonnage, shipping point. Address No. 779, Mining & Engineering World, Chicago.

WANTED — CAPITAL FOR MINERAL prospecting in Nevada. Geologist and chemist in party. All experienced prospectors. References. Address G. Lucas, Oil City, La.

WANTED — $15,000 TO BUILD PLANT near Kelvin, Ariz. Will give one-third interest in property that will net $250 daily. Full particulars given to interested parties. Address H. C. Phelps, 539 East 4th St., Long Beach, Calif.

BACK NUMBERS OF MAGAZINES SUPplied promptly and at moderate rates; also clippings on any subject. Books and magazines of all kinds bought. A. W. Castellanos, 259 Armstrong Ave., Jersey City, N. J.

MANY OPPORTUNITIES. BEST SERvice. All Arizona stocks handled. Maps and information on request. J. C. Scott & Co., Jerome, Ariz.

FOR SALE—GREATER MIAMI COPPER Co. stock, block of 25,000 shares. Authorized by Arizona Corporation Commission to be sold at 50 cts. a share; company owns 20 claims in Mineral Creek section of Globe-Miami Mining district. Development work is being pushed and excellent ore is opened up. H. H. Brown, Mining Broker, Box 4, Miami, Ariz.

RELIABLE INFORMATION FURNISHED regarding Butte, Mont., and vicinity. Concerning mines, mining property, stocks, deeds, claims, persons, etc. Collections made. Strictly confidential. Western Information Bureau, Butte, Mont.

FOR RELIABLE INFORMATION ON western mining properties, write A. A. Charonnat, Mining Engineer, Nevada City, Calif.

DO YOU KNOW YOUR TAILINGS OR waste dumps do not carry values in some valuable metals? Why not send a sample and request for terms? E. C. Jordan, Gouverneur Laboratory, Gouverneur, N. Y.

FOR SALE—FACTORY SITE. ADAPTED for foundry, machine shop or steel mill. This tract contains 36 acres, having a frontage of 400 ft. on the Iron Mountain Railroad, also Frisco connections. Located about 9 miles from St. Louis, within 4 miles of the by-product coke ovens on the same line of road. The tract has now foundations for a steel plant or foundry, with sufficient water on the property for any purpose. This is one of the choicest locations for manufacturing near St. Louis. Call or address F. P. Fay, 1034 Pierce Bldg., St. Louis,, Mo.

CORPORATION CHARTERS, ETC.

INCORPORATORS, LAWYERS, PROMOTers recommend Nevada charters. Unequaled advantages, economy, simplicity, convenience. "Howbook—MW" free. Corporation Service System (MW), Reno, Nevada; Clarksburg, West Virginia. Incorporates companies any state. Experienced local counsel.

INCORPORATE YOUR BUSINESS UNder Arizona laws. Cost small; no franchise tax; stockholders exempt from corporate debts; do business anywhere; law and form free. Southwestern Securities & Investment Co., Box M488, Phoenix, Ariz.

FOR SALE—MINING MACHINERY

FOR SALE — COMPLETE DIAMOND drill outfit, including "A" rods, boilers, piping, pumps, etc. Good condition. Address "M," Mining & Engineering World, Chicago.

FOR SALE — STEEL HEADFRAME— Height 70 ft., 2 compartments and dinky shaft, with or without ore handling platform; stored at eastern plant; new and cheap for quick sale. El Paso Bridge and Iron Co., El Paso, Texas.

NEW GASOLINE HOIST, SHEAVE, shaft, boxes rope and buckets, $350. Also 2-stamp mill; rolls; Pelton water wheel; Chilian mill. W. F. Downie, Shannon Ave., Spokane, Wash.

BRAND NEW 6-HP. GASOLINE HOIST, $285; also 2-stamp mill and 25-hp. water tube boiler, built sectional. W. F. Downie, Shannon Ave., Spokane, Wash.

FOR SALE—12-IN. MORRIS SAND PUMP; 12-in., 8-in., 6-in. centrifugal submerged pumps; 36-ft. Lockwood buckets; 60-ft. American guy derrick; 20-ton Davenport saddle-tank stand gage locomotive; new 80-H.P. firebox boiler. Address A. V. Konsberg, 226 S. La Salle St., Chicago.

FOR SALE — AMERICAN DIAMOND drill, No. 10, complete outfit. Brinsmade, 4429 Morgan St., St. Louis, Mo.

MACHINERY WANTED

WANTED TO BUY — HIGHEST CASH prices paid for second-hand diamond, used carbons and fragments. Francis & Co., First National Bank Bldg., Hartford,

SECOND-HAND CYANIDE PLANT. FULL particulars to "Cyanide," Box 40, Cobalt, Ont., Can.

The Cripple Creek Times-Record.

the World's Greatest Gold Camp's Greatest Newspaper. Chuck full of the latest mining news of the Cripple Creek District.

Several Lots of New and Second Hand

Standard Rotary Mine Cars

AT A LOW FIGURE

Also new and re-laying rails, 12, 16, 20 and 25 lb. Immediate delivery.

The Atlas Car and Manufacturing Co.

Cleveland, Ohio

Bargains in Mining Machinery for Immediate Delivery

24x14 heavy pattern rolls.
5-ft. Huntington mill.
2x6 Dewco Richard's pulsator classifier.
2x6 Dewco Richard s pulsator jig.
32x6 trommel.
No. 5 Friemier sand pump.
No. 0 Gyratory crusher.
6-ft. iron frame Frue vanner.
10 HP. gasoline engine.
90 HP. steam engine.
Double drum electric hoist with 440 volt A C motor, capacity 3000 lbs. 100-ft. a minute.
427 cu. ft. steam compressor, 50 HP., 220 volt, A C motor.
100 K V A, 220 volt, A C generator with exciter and switchboard.
Also a complete 50-ton concentrating mill.
All of the above are in fine shape, practically as good as new, and are being offered for immediate delivery, subject to prior sale, at very low prices.

HALLIDIE COMPANY *Dealers in*
Spokane, Wash. *Mining Machinery*

Geology Applied to Mining

By JOSIAH EDWARD SPURR, A. M.

Postpaid, $1.50

MINING WORLD COMPANY, Chicago

The Assay of Tin and Antimony

Second Edition By L. PARRY, A. R. S. M. **Price $1.25**

MINING WORLD COMPANY, CHICAGO

Advertised machinery is the most dependable.

Machinery for Immediate Delivery

Morse "TYPE A" Filter.

Complete with motor, two buckets, all tanks, vacuum pumps, hydraulic crane for handling baskets, capacity 300 tons per 24 hours.

Portland Filter.

One Portland Filter, complete specifications on request.

ELECTRIC HOISTS.

1—50-hp., 3-phase, 60-cycle, 440-volt.
1—35-hp., 3-phase, 60-cycle, 440-volt.
1—20-hp., 3-phase, 60-cycle, 440-volt.
1—15-hp., 3-phase, 60-cycle, 440-volt.
1—10-hp., 3-phase, 60-cycle, 440-volt.
2—7½-hp., 3-phase, 60-cycle, 440-volt.

CRUSHERS

1—5x7 Steel Roll Jaw Crusher.
1—7x10 Blake Crusher.
1—7x11 Dodge Crusher.
1—7x16 Sampson Crusher.
3—9x15 Blake Crushers.
1—9x16 Western Steel Crusher.
1—No. 3 Aurora Crusher.
1—No. 2 Gardner Crusher.
1—No. 1 D Gates Crusher.
1—No. 3 D Gates Crusher.
1—Size "C" Comet Crusher.

ROLLS

1—Set 6x10 Sample Rolls.
1—Set 12x20 McFarlane Rolls.
2—Sets 14x27 Davis Rolls.
1—Set 10x30 Allis-Chalmers Rolls.
1—Set 16x36 Davis Rolls.
1—Set 16x40 Colo. Iron Works Rolls.
1—Set 3x10 Triplex Rolls.
1—Set 5x18 Triplex Rolls
3—Sets 6x24 Triplex Rolls.

BELT DRIVEN AIR COMPRESSORS

1—10x12 Sullivan Single.
1—12x10 Blaisdell Single.
1—12x10 Ingersoll-Sergeant Single
1—18 and 10x10 Clayton, 2-stage.
1—18 and 10x12 Laidlaw-Dunn-Gordon, 2-stage.
1—24¼ and 14¼x14 Ingersoll Rand, 2-stage.
3—28 and 17x24 Ingersoll-Rand, 2-stage.

TUBE AND BALL MILLS

1—5x24-ft. Tube Mill.
1—5x22-ft. Abbe Tube Mill.
1—48x16-ft. Abbe Tube Mill.
1—48x12-ft. Traylor Tube Mill.
1—6x9-ft. Gates Ball Mill.
1—5x7 Standard Ball Mill.
1—5x4 Standard Ball Mill.
1—4x3 Standard Ball Mill.

PULVERIZERS AND MILLS

5—5-ft. Huntington Mills.
2—6-ft. Huntington Mills.
1—50-in. Standard Pulverizer.

WATER WHEELS

1—18 Morgan Smith Turbine.
1—35-in. Samson Turbine.
1—3-ft. Hug Water Wheel.
1—4-ft. Pelton Water Wheel.
1—5-ft. Pelton Water Wheel.

Send for our Complete Machinery List.

The Morse Bros. Machinery & Supply Co.
1732 Wazee Street - - - Denver, Colorado

SPECIAL SNAPS!

Mining Machinery and Equipment

Buy your mining and engineering equipment from the Great Price Wreckers at "Busted" prices. Do not pay the "Boosted" prices others ask for equipment. Our vast operations constantly secure us snaps of every kind.

Air Compressors

4 Ingersoll-Rand portable air compressors, cylinders 10x8, capacity 107-cu. ft. per minute, at 100 lbs. pressure. Mounted on heavy steel trucks, belted to 15-hp. Fairbanks-Morse gasoline engines—complete.

2—9x9x9 Westinghouse Steam-driven air compressors.

2—20 x 20¼ x 24 Ingersoll-Sargeant Straight line air compressors, and other portable and stationary compressors.

Drills, Crushers

6—2¼-in. Sullivan Drills complete with tripods and weights, or tunnel columns for steam or air.

4—2¼-in.; 3—2¾-in.; 2—5-in. Rand Slackers.

1—No. 5 B Gates Gyratory crusher with elevator and screens.

2—No. 4 B Gates Gyratory crushers with elevator and screens.

8 miscellaneous gasoline and steam concrete mixers, up to 10 cu. yds.

Cable Chain, Rope

We recently secured 100,000 ft. of 1-in. and 1¼-in. wire rope; 90 tons of chain of all kinds, also cables, etc.; and a miscellaneous lot of electric conductor wire and cable. Write us your needs.

Steam Hoists

The following hoists will be sold at savings of 40 to 60 per cent.

1—6x8 double cylinder, double drum hoisting engine and boiler.
1—6x18, D. C., D. D. Hoisting engine and boiler.
1—8¼x12 double cylinder, triple drum hoist with slewing engines.
2—8¼x10 triple drum hoists.
2—8¼x10 double drum hoists.
2—6x8 single drum hoists.
2—12-hp. gasoline hoisting rigs with double drum and all equipment.

Belted Hoists

1—5000 lb. D. D.
1—3000 lb. D. D.
1—2000 lb. D. D.
1—3000 lb. S. D.
1—2000 lb. S. D.
1—1000 lb. S. D.

Pumps and Miscellaneous Equipment

1—5x8 Goulds triple.
1—4-in. centrifugal.
1—5-in. centrifugal.
1—6-in. centrifugal.
1—8-in. centrifugal.
1—10-in. centrifugal.
1—14x10¼x10 Worthington Duplex.
1—12x8½x10 Worthington Duplex.
1—30-hp. mounted kerosene engine.
1—25-hp. mounted kerosene engine.
1—20-hp. mounted kerosene engine.
1—15-hp. mounted kerosene engine.
1—5-ton standard gage Northern locomotive crane, 36-ft. boom.
1—No. 1 Cincinnati double end punch and shear.

Overhauled Standard Pipe. Air and Steam Hose of Every Kind.

Chicago House Wrecking Co., 35th & Iron Sts., Chicago

Mining Law

FOR THE

Prospector, Miner, and Engineer

By H. W. MacFARREN

356 PAGES INDEXED ILLUSTRATED

$2 POSTPAID

A valuable and convenient reference book for the prospector and mineral surveyor and for all interested in the laws relating to mines and minerals. The result of wide practical experience put in a form easily grasped by the layman; where, by whom, and how locations may be made; how to hold a claim; lode, placer, and mill and tunnel site locations; how to obtain patents; survey, application, and entry; extralateral rights; regulations governing Federal lands; State statutes on mines and minerals. By an experienced mineral examiner of the Federal service.

MINING WORLD COMPANY
Monadnock Block, CHICAGO

COMPETENT MINING MEN SUPPLIED
MANAGERS ENGINEERS MILLMEN &c
TECHNICAL MEN
THE MINES TECHNICAL AGENCY
Washington Building LOS ANGELES

METALLURGY By HERBERT LANG

Vol. 1. 248 Pages, 6x9, Illustrated

$3.00 (12 | 6) Net, Postpaid

Volume I is a unit dealing with the fundamental processes of metallurgy.

MINING WORLD CO., Monadnock Block, CHICAGO

STAMP MILLING

A TREATISE ON PRACTICAL STAMP MILLING AND STAMP MILL CONSTRUCTION

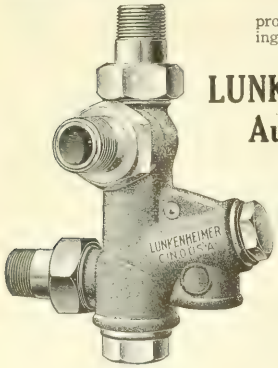
By ALGERNON DEL MAR, Mem. A. I. M. E., Etc.

134 Pages, 6x9, Illustrated
$2.00 (8 | 6) net, Postpaid

CONTENTS: I. Evolution of the Stamp Mill. II. General Principles of the Stamp Mill. III. Practical Working of the Stamp Mill. IV. Limitations of the Single Unit and Five Stamp Unit Batteries. V. History of Amalgamation. VI. Amalgamation. VII. Stamp Mill Construction.

MINING WORLD COMPANY, CHICAGO

Comparative tests—



prove that for efficiency, delivering capacity and durability, the

LUNKENHEIMER Automatic Injector

is unequalled. It is absolutely automatic at all times and can be relied upon to re-start instantly after a temporary interruption of either the steam or water supply.

Will deliver more water per pound of steam, and has full capacity at higher steam pressures than others.

Exceptionally durable; a special hard bronze composition is used for the tubes, all parts are interchangeable and can easily be renewed.

The **LUNKENHEIMER EJECTOR** embodies the same excellence in design as the Injector. It is particularly adapted for raising water from deep wells, mines or pits, filling or emptying tanks, etc.

Ask your dealer for Booklet No. 504.

THE LUNKENHEIMER CO.
"QUALITY"
Largest Manufacturers of High Grade Engineering Specialties in the World

New York Chicago CINCINNATI Boston London

19-7-32

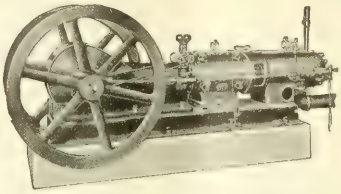
Fuel Oil Driven Compressors

Combining the Superior Merits of the

GIANT ENGINE

and

CHICAGO PNEUMATIC COMPRESSOR



Stationary or tank mounted for portable use.

Class N-SO "Chicago Pneumatic" Compressors are made in capacities up to 550 cu. ft. and will operate successfully on

Crude Oil	Stove Oil	Diesol	Coal Oil
Fuel Oil	Star Oil	Solar Oil	Kerosene
Residuum	Calol	Gas Oil	

which means LOW OPERATING COST.

No valves, gears, carburetors, mixers, oil or air heaters, magnetos, batteries, timers, switches, coils, wires or spark plugs.

Write for Bulletins.

Chicago Pneumatic Tool Co.

1033 Fisher Bldg., CHICAGO 52 Vanderbilt Av., NEW YORK

Branches Everywhere. A-3

Chas. C. Moore & Co. Engineers

San Francisco, Calif.

Complete Power Plants Boilers, Engines, Condensers, Pumps, Hoists, Compressors, Heaters, Purifiers, Valves and all Power Plant Auxiliaries.

Wuest Herringbone Gears

We have exceptional facilities for giving prompt service since we produce our own steel forgings and castings. Our steel foundry can produce castings up to 50 tons.

Experienced Engineers in determining Gear Problems are at your service.

The Falk Company, Milwaukee, Wisconsin

STEEL FORGINGS

Forgings 300 to 30,000 Pounds Each
Rough Machined or Finished Complete

Crusher and Hoist Shafts a Specialty

We are supplying many of the largest manufacturers and users of mining, milling and power transmission machinery. Also Car and Locomotive Axles to Railroad Specifications.

STANDARD FORGINGS COMPANY

Sales Offices—Railway Exchange Bldg., CHICAGO, ILL.
Works—INDIANA HARBOR, IND.

AWARDED
PANAMA PACIFIC INTERNATIONAL EXPOSITION GRAND PRIZE

Every coil examined and labeled under the direction of the underwriters laboratories. Ignition wire for autos, motor boats and aeroplanes. *Send for booklet fully describing.*

American Steel & Wire Company

Chicago New York Cleveland Pittsburgh Worcester Denver
Export Representative: U. S. Steel Product Co., New York
Pacific Coast Representative: U. S. Steel Product Co.
San Francisco Los Angeles Portland Seattle

DO YOUR PROSPECTING

With an

Armstrong Prospecting Churn Drill

The Most Simple, Durable and Efficient Churn Drill Manufactured.

Used by the largest mining companies in the world in preference to any other machine on account of the ECONOMY IN OPERATION.

Equipped with gasoline or electric power—portable or traction. Capacities—200 to 1,500 feet.

Write for Catalog and State Requirements ARMSTRONG MFG. CO., 700 Chestnut Street WATERLOO, IOWA

Index to Advertisements

A

Abbé Engineering Company, 222-224 Broadway, New York...112
Albany Lubricating Co., New York..... 2
Aldrich Pump Company, Allentown, Pa.....
Allis-Chalmers Mnfg. Co., Milwaukee, Wis.....101
Almy Water Tube Boiler Company, Providence, R. I.....104
Ambursen Company, Tramway Department, New York..... 24
American Bridge Company, 30 Church St., New York.....
American Cast Iron Pipe Company, Birmingham, Ala.....
American Locomotive Co., 30 Church St., New York..... 15
American Sheet & Tin Plate Co., Pittsburgh.....103
American Smelting & Refining Co.....105
American Spiral Pipe Works, P. O. Box 485, Chicago.....
American Steel & Wire Co., 208 S. La Salle St., Chicago....126
American Zinc Lead & Smelting Co., New York..... 4
American Zinc Ore Separating Co., Denver..... 10
Armstrong Mfg. Co., Waterloo, Iowa.....126
Armstrong Manufacturing Company, Bridgeport, Conn.....111
Atlas Car & Manufacturing Company, Cleveland, Ohio....2-124

B

Bacon, Earl C., New York.....112
Baldwin Locomotive Works, Philadelphia.....
Bartlett & Snow Company, C. O., Cleveland, O..... 16
Beer, Sondheimer & Company, Inc., 61 Broadway, New York.106
Briesemeister, A., 1656 Holland Ave., New York.....121
Broderick & Bascom Rope Company, St. Louis..... 29
Brokers and Bankers.....121
Brown Palace Hotel, Denver, Colo.....113
Buchanan Co., C. G., New York.....112
Bureau of Mining Information.....115
Business Men's Clearing House, Denver, Colo.....124
Byron & Hall, 116 Broad St., New York.....

C

Cameron Steam Pump Works, 11 Broadway, New York.....128
Carbo Steel Post Co., Rand-McNally Bldg., Chicago.....
Ceresit Waterproofing Company, Chicago.....
Chalmers & Williams (Inc.), Chicago Heights, Ill.....
Chicago Belting Co., 123 N. Green St., Chicago.....131
Chicago House Wrecking Co., 35th and Iron Sts., Chicago..125
Chicago Perforating Co., 24th Pl. and Western Ave., Chicago.104
Chicago Pneumatic Tool Co., Chicago.....126
Clow & Sons, Jas. B., Chicago, Ill.....
Colorado Fuel & Iron Co., Denver, Colo..... 7

D

Danville Foundry & Machine Company, Danville, Ill.....112
Daum Company, A. F., Pittsburgh.....
Deister Machine Co., Fort Wayne, Ind..... 16
De Laval Steam Turbine Co., Trenton, N. J..... 22
Denver Engineering Works, Denver..... 7
Denver Quartz Mill & Crusher Company, Denver, Colo.....102
Denver Rock Drill Mfg. Co., 18th and Blake Sts., Denver..... 17
Diamond Drill Carbon Co., New York.....130
Diamond Drill Contracting Co., Spokane, Wash.....103
Dick, Ltd., R. & J., Passaic, N. J.....110
Dickinson Manufacturing Company, Springfield, Mass.....
Dillon Box Iron Works, 1846 Blake St., Denver..... 7
Dixon Crucible Company, Jersey City, N. J.....109
Dodge Sales and Engineering Company, Mishawaka, Ind..... 21
Donaldson Iron Co., Emaus, Pa.....
Dorr Company, The, 1009 17th St., Denver, Colo.....7-109
Dunn & Kruse, 55-63 Park Row, New York.....130
du Pont Powder Co., Wilmington, Del.....
Dwight & Lloyd Sintering Company, 25 Broadway, N. Y.....102

E

Earle, E. P., 165 Broadway, New York.....130
Eccleston Machinery Co., Los Angeles.....
English Iron Works Company, Kansas City, Mo.....

F

Falk Company, Milwaukee, Wis.....126
Fate & Company, J. D., Plymouth, O..... 22
Fawcus Machine Company, Pittsburgh.....
Flory Manufacturing Company, Bangor, Pa..... 19
Francis & Company, 50 State St., Hartford, Conn.....103
Freeman & Sons Mfg. Co., S., The.....129

G

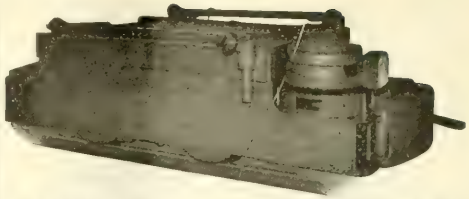
Gandy Belting Company, 750 W. Pratt St., Baltimore, Md... 20
General Electric Company, Schenectady, N. Y.....
General Naval Stores Company, New York.....102
Georgia Pine Turpentine Co., New York.....102
Gibson Company, Wm. D., Huron & Kingsbury St., Chicago. 16
Glamorgan Pipe & Foundry Co., Lynchburg, Va.....
Goldsmith Bros. Smelting & Refining Co., Chicago.....107
Goodman Manufacturing Company, Chicago..... 22
Goulds Mfg. Co., Seneca Falls, N. Y.....
Granby Mining & Smelting Co., St. Louis.....107

H

Hallidie Company, Spokane, Wash.....124
Hardinge Conical Mill Company, 120 Broadway, New York..102
Hegeler Zinc Co., Danville, Ill.....107
Hendrie & Bolthoff Mfg. & Sup. Co., 1621-39 17th St., Denver.2-7
Henry Heil Chemical Company, St. Louis, Mo.....108
Hercules Powder Co., Wilmington, Del.....
Hotel McAlpin, Broadway and 34th St., New York.....113
Holmes & Bros., Robt., Danville, Ill.....112
Hyatt Roller Bearing Company, Newark, N. J..... 6

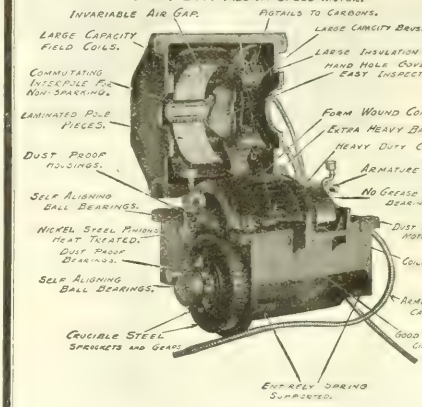
I

Imperial Brass Manufacturing Co..... 22
Ingersoll-Rand Company, 11 Broadway, New York..... 3
International High Speed Steel Company, New York.....132
International Smelting Company, 42 Broadway, New York..106



MINING LOCOMOTIVES

You Will Appreciate, Your Engineers Approve, and Your Motorman Praise, Every Feature



A BALANCED locomotive for best track behavior.

Power to slip the wheels continuously without overload to any part.

Spring cushioned throughout to absorb all shocks.

Completely enclosed against dust and grit.

All parts easily inspected and accessible.

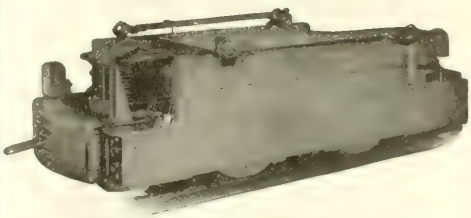
Large, medium speed, low temperature, inter-pole type motor, equipped with self-aligning bearings.

Liberally proportioned, ventilated armature with latest design formed coils, avoiding complicated bends.

Large, solid true running commutator with extra thick end plate insulation rings and kept firm by ample clamping bolts, preventing heat, wear and sparking.

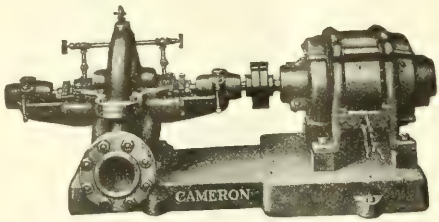
Laminated pole pieces with cool, low resistance, form wound field coils heavily insulated.

MORGAN-GARDNER "ELECTRIC CO." 68 E. ADAMS ST. CHICAGO USA



THE SLOGAN OF THE CAMERON—"CHARACTER: THE GRANDEST THING."

How To Reduce Your Pump Costs



There are two vital essentials for the reduction of pump costs—highest efficiencies and low operating expense. These essentials are splendidly met in

Cameron Centrifugals

Back of Cameron high efficiency is simplicity and excellence of design. Back of Cameron low up-keep are rigid elimination of the unfit in choosing material and thoroughness in manufacture. Back of Cameron low operating costs are these same elements.

The above illustration shows you the simplicity of one Cameron—the Cameron Double-Suction Volute Centrifugal Pump. Note the horizontally split casing, allowing quick, easy access to all working parts. The impeller is enclosed and perfectly balanced, insuring smooth, easy operation, and a long life of service.

Cameron Centrifugals are built in many types and sizes, and for any drive.

If you want your pumping done at the least ultimate expense, put it up to the Cameron.

Ask for Bulletin No. 150—it's free.

A. S. CAMERON STEAM PUMP WORKS
11 BROADWAY : NEW YORK

Offices the World Over.

INDEX TO ADVERTISERS—Continued.

J

James Ore Concentrator Co., Newark, N. J.....104
Jeffery Company, The Thomas B., Kenosha, Wis..... 13
Jenkins Brothers, 80 White St., New York..... 24
Johnson Engineering Works, 1st Nat. Bank, Chicago.....111

K

K.-G. Welding & Cutting Co., 556 W. 34th St., New York.... 2
Kaiserhoff Hotel, Chicago.....113
Kalbfleisch Co., Franklin H., New York.....132
Keystone Lubricating Company, Denver, Colo.....
Koering Cyaniding Process Company, Detroit 129

L

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.....104
Levine, Abr., 25 Nassau St., New York.....103
Lidgerwood Manufacturing Company, 95 Liberty St., N. Y.... 17
Lunkenheimer Company, Cincinnati, O.....126
Lynchburg Foundry Co., Lynchburg, Va.....

M

Marion Steam Shovel Co., Marion, O.....
Massillon Iron & Steel Company, Massillon, O.....
McKiernan-Terry Drill Company, 231 Broadway, New York.103
Merrick Scale Mfg. Co., Passaic, N. J.....
Metals Recovery, Incorporated.....
Midland Crusher-Pulverizer Co., Chicago.....129
Mine & Smelter Supply Co., 17th and Blake Sts., Denver.... 7
Minerals Separation Am. Syndicate, San Francisco..... 18
Mines Technical Agency, Los Angeles.....125
Monarch Engineering & Manufacturing Company, Baltimore 2
Moore & Co. Engineers, Chas. C., San Francisco.....126
Morgan-Gardner Electric Company, 60 E. Adams St., Chicago.127
Morse Bros. Machinery & Supply Co., Denver.....21-125
Morse Chain Co., Ithaca, N. Y.....
Moyle Engineering & Equipment Co., Los Angeles, Calif...

N

National Tube Company, Pittsburgh, Pa.....1-112
Naval Consulting Board of U. S. A.....12
Newhouse Hotel, Salt Lake, Utah.....113
New York Engineering Company, 2 Rector St., New York....104
Nordberg Manufacturing Company, Milwaukee, Wis.....
Norwalk Iron Works Company, Norwalk, Conn..... 3

P

Pelton Water Wheel Co., San Francisco.....112
Pensacola Tar & Turpentine Company, Gulf Point, Fla.....102
Philipp Brothers, 42 Broadway, New York.....107
Powell Company, Wm., Cincinnati, O..... 20
Power & Mining Machinery Company, Milwaukee, Wis.....
Prest-O-Lite Company (Inc.), Indianapolis..... 23
Prescott Steam Pump Company, Milwaukee, Wis.....
Prill, Arthur, New York..... 114
Primos Chemical Company, Primos, Pa.....130

R

Riblet Tramway Company, Spokane, Wash.....108
Richardson Scale Company, Passaic, N. J.....
Robins Conveying Belt Co., New York.....112
Roebling's Sons, John A., Trenton, N. J.....111
Roessler & Hasslacher Chemical Co., 100 William St., N. Y..109
Ruggles-Coles Engineering Co., New York-Chicago.....132

S

Samson Crusher Mfg. Co., 33d and Blake Sts..... 7
Sandoval Zinc Company, Chicago.....107
Santa Fe Railway.....110
Sauerman Bros., 330 Dearborn St., Chicago..... 22
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.....112
Scott, George S., 35 Nassau St., New York.....130
Second-Hand Machinery Department.....124-5
Senn Concentrator Co., San Francisco.....
Shaw (C. H.) Pneumatic Tool Co., 35th and Wazee, Denver.. 7
Skinner & Company, M. B., 358 W. Washington, Chicago....3-8
Southwark Foundry & Mach. Co., Philadelphia..... 33
Spitzglass, J. M., Peoples Gas Bldg., Chicago.....
Staley, Harry D., Nevada City, Calif.....
Standard Cast Iron Pipe & Fdy. Co., Bristol, Pa.....
Standard Diamond Drill Company, 1st Nat. Bank, Chicago..103
Standard Forgings Co., Railway Exchange, Chicago.....126
Standard Oil Company, 72 West Adams St., Chicago..... 15
Standard Spiral Pipe Works, 1st Nat. Bank, Chicago..... 16
Stearns-Roger Mfg. Co., Denver, Colo..... 7
Stoneham, Charles A., New York.....130
Stromberg-Carlson Telephone Mfg. Co.....

T

Taylor Foundry & Engineering Co., Grass Valley, Cal.....
Thompson Balance Company, Denver, Colo.....109
Traylor Engineering & Manufacturing Co., Allentown, Pa.... 9
Troemner, Henry, 911 Arch St., Philadelphia, Pa.....109
Truax Manufacturing Co., 1117 Wazee St., Denver..... 7

U

Union Construction Company, San Francisco, Calif.....104
U. S. Cast Iron Pipe & Foundry Co., Chicago, Ill.....
U. S. Smelting, Refining & Mining Company, Boston.....106

W

Want Advertisements 122-3-4
Weber Chimney Co., 333 S. Michigan Ave., Chicago.....110
Wedge Mechanical Furnace Company, Philadelphia, Pa..... 11
Weigele Riveted Steel Pipe Works, Denver..... 7
Wellman-Seaver-Morgan Company, Cleveland, O..... 3
Western Electric Company, New York.....
Westinghouse Electric & Mnfg. Co., E. Pittsburgh.....
Weston Electrical Instrument Co., Newark, N. J.....108
Wiggins Company, John B., 61 E. Adams St., Chicago.....111
Wile Electric Furnace Company, Pittsburgh..... 24
Wood Drill Works, 30 Dale Ave., Paterson, N. J.....103
Worthington Pump and Machinery Corporation 19

Y

Yuba Construction Co., San Francisco.....104

Z

ZIN-HO Manufacturing Co., 1326 S. Michigan Ave., Chicago.. 18

Save More Values in

Cyaniding

Do It Quicker and at Less Cost

THE KOERING CYANIDING PROCESS CO.

is building machines under the Koering patents, guaranteeing results. Many tests at our laboratory show from 10% to 20% greater saving at a fraction of time and cost of other methods.

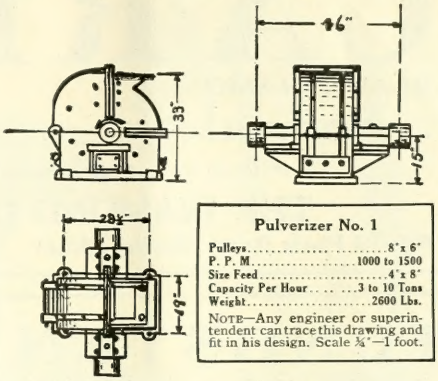
Don't let this statement deter you from at least investigating. We are ready to prove it to your entire satisfaction.

Send us an analysis of your ore, or, better still, arrange with us for a mill test. State how many tons desired to treat per day, and we will submit figures that will surprise you.

Write us today.

Koering Cyaniding Process Co. *511 Hammond Bldg., Detroit, Mich.*

For Any Crusher Plant Design



Pulverizer No. 1

Pulleys	8" x 6"
P. P. M.	1000 to 1500
Size Feed	4" x 8"
Capacity Per Hour	3 to 10 Tons
Weight	2600 Lbs.

NOTE—Any engineer or superintendent can trace this drawing and fit in his design. Scale ¼"—1 foot.

The Brainard Pulverizer

occupies small space, is compact, economical and efficient. Low in maintenance cost—no screen troubles. Made in four sizes.

Write for further information.

MIDLAND CRUSHER-PULVERIZER COMPANY
Old Colony Building, CHICAGO

Sales Agents for the UNIVERSAL CRUSHER CO.

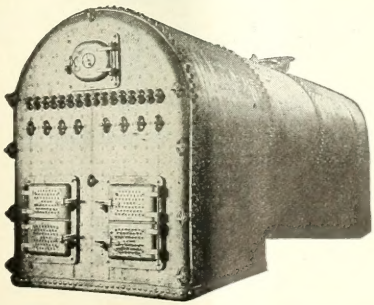
PRACTICE OF COPPER SMELTING

By DR. EDWARD DYER PETERS of Harvard University. 693 *pages*, 6x8, *over* 100 *illustrations*, **$5.00** (21*s*) *net, postpaid*

¶ A book on modern, actual methods with just enough of the principles to give a clear understanding of the reasons for each operation. The author presents this work after an immense amount of investigation and research. It describes the regular and research methods used by the principal American smelting companies. It treats with care and thoroughness many matters which cannot be found elsewhere. Among these are: Oil as a fuel in reverberatory smelting; pulverized coal in reverberatories; modern converter practice with actual costs and results; basic-lined converter with plans; fines, slags, and other subjects as the table of contents indicates.

Contents: The Ores of Copper. The Sampling of Copper Ores. Method of Copper Extraction. The Behavior of Ores at High Temperature. Roasting. The Blast Furnaces. Blast Furnace Smelting. True Pyrite Smelting. Partial Pyrite Smelting. Reverberatory Furnaces. Reverberatory Smelting with Wood. Blast Furnace *versus* Reverberatory. Fines. The Production of Metallic Copper from Matte. The Refining of Copper. Fine Dust and Smoke. Slags. Miscellaneous.

FOR SALE BY **MINING WORLD CO., Monadnock Block, CHICAGO**



Freeman Copper Country FIREBOX BOILER

Built especially for Mine Purposes.
Is portable and requires no brickwork.
The Freeman Copper Country Firebox Boiler is built in sizes from 100 to 300 H.P. The working pressure is from 150 to 200 pounds.
It is high in efficiency and low in upkeep.

Blueprints, specifications and prices on request.

The S. Freeman & Sons Mfg. Co.

333 Mich. Ave., RACINE, WIS., U. S. A.

CARBONS

BLACK DIAMONDS FOR CORE DRILLS

CARBONS AND BORTZ FOR ANY AND ALL INDUSTRIAL REQUIREMENTS

Write or wire at our expense for prices and full information.

THE DIAMOND DRILL CARBON CO.

53-63 Park Row, (World Bldg.) New York City

TUNGSTEN

Highest prices paid for Tungsten Ores of all kinds:—

Huebnerite **Scheelite**
Wolframite **Ferberite**

Largest Consumers of Tungsten Ores in the World.

Largest Manufacturers of Molybdenum, Tungsten and Vanadium Products.

PRIMOS CHEMICAL CO.

Primos, Delaware County, Pa.

Business Established, 1888.

Cable Address: "Briquette, Philadelphia." Telegraph Address: Philadelphia.

RARE MINERALS

RELIABLE INFORMATION regarding the values of and demand will be furnished PRODUCERS and CONSUMERS on application.

E. P. EARLE, 165 Broadway, New York

MINERALS

We buy, sell and exchange Barytes, Clays, Colors, Talcs and other minerals. PRODUCERS and CONSUMERS ONLY.

Write for, or send Samples.

DUNN & KRUSE, 53-63 Park Row, New York

Mineral Specimens
of Any Kind Bought and Sold

I Buy and Sell Mineral Collections

I especially want to purchase very choice specimens. In your mining operations now and then you run across mineral specimens that the mineral collector is willing to pay high price to secure. Take advantage of the market and demand for high-grade and rare minerals. Send me sample of what you find. I will examine specimens free and notify you what I am willing to pay.

A Mineral Collection for the Mining Engineer, Superintendent, Student or Anyone

COLLECTION IS 100 SPECIMENS. ALL THE COMMERCIALLY VALUABLE ORES AND MAINLY CRYSTALLIZED. EVERY SPECIMEN LABELED.

Collection contains specimens of free gold, native silver, native copper, native bismuth, native antimony, likewise the rare Uranium-radium minerals, Uraninite or Pitchblende, Carnotite, Torbernite, Autunite and Samarskite.

Pamphlet of this collection gladly furnished.

GEORGE S. SCOTT

Room 25, 20 Nassau St., New York

1916 HANDBOOK

OF

Curb, Mining, Oil

AND

Industrial Securities

giving vital statistics on more than

500 Securities

Now ready for distribution.

Copies may be obtained, without charge, from us, on request.

Address

Charles A. Stoneham & Co.

P. O. Box 53, Wall St. Station

New York City

SEA LION

WATERPROOF LEATHER BELTING

EVEN IF CONSTANTLY EXPOSED TO WATER OR STEAM, OR IF RUN IN FLOODED WHEEL PITS SEA LION WILL NOT COME APART AT LAPS OR JOINTS NOR LOSE ITS RESILIENCY.

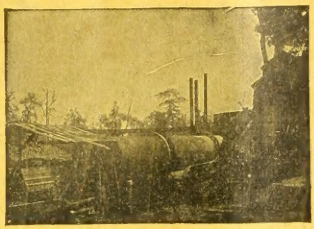
Chicago Belting Company

New York
Cleveland
Detroit
New Orleans

123 North Green Street,
Chicago, U. S. A.

San Francisco
Los Angeles
Portland
Seattle

13



Dryers for Ores

Ruggles-Coles Double-Shell Dryers are being used throughout the country to eliminate moisture from ores. Their construction is such that no other system can compete with them on account of the high efficiency obtained and their mechanical perfection.

Ruggles-Coles Engineering Company

Hudson Terminal, New York — McCormick Building, Chicago 2

Franklin H. Kalbfleisch Co.

31 Union Square West
New York

Manufacturers of **Chemicals**

Alum, all grades.
Sulphate of Alumina

Aqua Ammonia
SULPHURIC Acid
Nitric Acid
Muriatic Acid

And a General Line of
HEAVY CHEMICALS

Works: BROOKLYN, N. Y.
ERIE, PA.
ELIZABETHPORT, N. J.
WATERBURY, CONN.

"Bulldog" Rock Drill Steel

The "Champion H." Bit

U. S. Patent No. 1,043,855.

Each Bar is Warranted

A Trial of Bit and Steel

Trade Mark

Reg. U. S. Pat. Off.

Solid

All Sizes and Sections in Stock

Hollow

Will Prove Their Worth

Made only by the

International High Speed Steel Co.

Works: Rockaway, N. J. — Main Office: New York City